1985 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

SECOND SESSION

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1985 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

THURSDAY, FEBRUARY 2, 1984

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:36 a.m., in room 2318, Rayburn House Office Building, Hon. Doug Walgren (chairman of the subcommittee) presiding.

Present: Representatives Walgren, Durbin, Brown, Valentine, Gregg, Skeen, and Sensenbrenner.

Mr. Walgren. Let me welcome you to our start in reviewing the authorization for the National Bureau of Standards for fiscal year 1985, along with two smaller organizations, the Office of Productivity, Technology, and Innovation and the National Technical Information Service.

The President's proposed budget for fiscal year 1985 includes $126.1 million for the National Bureau of Standards. This represents a $10.4 million increase over the current 1984 appropriation of $115.7 million. Included are program and facility increases which total $17.9 million and cost-of-living increases for employees of $7.5 million. The program reductions in the same proposal total $15 million.

For the second year in a row the administration has proposed drastic cuts in the computer standards development program, cuts totaling $5 million, and the elimination of two vital programs at the Bureau: The Fire Research Center, accounting for $5.1 million, and the Building Research Center, accounting for $3.2 million. Last year the Congress in its judgment restored funding for these activities because they were very constructive for society and cost effective and important. Again this year we will have to evaluate the importance of those programs and whether to continue them in comparison to the other programs that the administration offers support for.

In addition to these cuts, the administration has recommended eliminating funding for the measurement assurance programs, an amount of $1.2 million, and the national voluntary laboratory accreditation program, $500,000. New programs would be developed in these areas where increased fees to customers could support the entire effort.

The rationale behind all these cuts is that the Federal Government should not be involved in applied research which is more properly the role of the private sector. However, during authorization hearings held last year it was evident from the testimony given by outside witnesses that, in their views, these programs either could not or would not be carried out by the private sector. I think the subcommittee certainly needs to examine these proposals carefully in terms of their broader impact on not only the Bureau, but on the Nation's research and development effort as a whole.

This year the subcommittee will also pay particular attention to an issue which has gradually come to our attention in recent years, in part as a result of the successive proposals for budget reductions in high priority programs. This is the question of facility utilization, the question of whether we have facilities in the Federal Government, and in the Federal laboratories in particular, that may be underutilized. This, of course, is a management problem that is one that has had the attention of the management at the Bureau for some time. It is a difficult thing, I think, to totally succeed at, but, nonetheless, we have assets in these laboratories of great national importance, and we want to encourage and stress the importance of their being used to their fullest capability.

I would like to ask Dr. Ambler, in particular, to talk with us a little bit about that informally.

Let me also take this opportunity to mention that last month we did visit the Bureau of Standards laboratory in Boulder. It was a good experience for me, in particular, and for the staff of the subcommittee to become more closely acquainted with the work that is being done there.

We appreciated very much the hospitality of the Director, Dr. Kamper, and certainly came away with the feeling that there is an awful lot of very good work that is being done and the hope that we can be supportive of the functions of the Bureau that really are so important to the country.

Well, with that for opening remarks, let me ask whether there are any other suggestions for starting the hearing.

Mr. Durbin.

[Mr. Durbin shakes head negatively.]

Mr. Walgren. If not, let's call the first witnesses, and let me invite those from the Bureau of Standards to come to the table: Dr. Ambler, we all know, the Director of the National Bureau of Standards, accompanied by Dr. John Lyons, who is the Director of the National Engineering Laboratory at the Bureau; Dr. Donald Johnson, the Director of the National Measurement Laboratory; James Burrows, the Director of the Institute for Computer Sciences and Technology; and Dr. Darrell Reneker, the Acting Director of the Center for Materials Science.

Well, gentlemen, welcome to the committee, and, as you know, written statements that you feel would be helpful to make in building the record that is necessary to evaluate the authorizations year by year will be made part of the record. We will encourage you to submit anything that you feel would be helpful to the committee in that vein, and would like to ask you to focus your oral remarks, as is comfortably possible, on points that you feel that attention of the

Members should be directly drawn to, in hopes that we will have some time for discussion and elaboration.

So, Dr. Ambler, please proceed. Welcome to the committee.

STATEMENT OF DR. ERNEST AMBLER, DIRECTOR, NATIONAL BUREAU OF STANDARDS, ACCOMPANIED BY DR. JOHN W. LYONS, DIRECTOR, NATIONAL ENGINEERING LABORATORY; DR. DONALD R. JOHNSON, DIRECTOR, NATIONAL MEASUREMENT LABORATORY; JAMES H. BURROWS, DIRECTOR, INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY; DR. DARRELL H. RENEKER, ACTING DIRECTOR, CENTER FOR MATERIALS SCIENCE; AND RAYMOND G. KAMMER, DEPUTY DIRECTOR, NATIONAL BUREAU OF STANDARDS

Dr. **Ambler**. Thank you, Mr. Chairman.

Again, I have the great pleasure of appearing before you and this Committee to request authorization of appropriations for the National Bureau of Standards, this time for fiscal year 1985.

You did mention my colleagues. I don't know whether you mentioned Mr. Kammer, however, who is the Deputy Director, and is seated on my left, whom you know.

Mr. Chairman, there was a statement made by the Committee that reported the bill to establish the National Bureau of Standards that has been a constant source of inspiration to us, and I would like to read that:

> It is, therefore, the unanimous opinion of your committee that no more essential aid could be given to manufacturing, commerce, the makers of scientific apparatus, the scientific work of the Government, of schools, colleges, and universities, than by establishment of the institution proposed in this bill.

This passage, written in 1900, has been so significant to the National Bureau of Standards that it was chiseled on the wall of the lobby in our Gaithersburg laboratory when it was completed in 1965. And, if I'm not mistaken, Mr. Chairman, on one of your numerous visits to the National Bureau of Standards, you had the opportunity to see that in the lobby.

These words are a constant reminder of the confidence that was bestowed upon the National Bureau of Standards by those who created it. We strive to remain worthy of this confidence, especially now when the Nation is calling upon industry, universities, and Government to increase their cooperative efforts in research and its application to advancing technology for the purpose of strengthening the U.S. economy.

Since the charge is even more meaningful and important today, we must do even more in executing our responsibilities. Now, more than ever, all NBS staff members, irrespective of their level in the organization, are required to interact broadly with their colleagues in other institutions. We see as measures of the success of these interactions many scientists and engineers from outside organizations working in collaboration with NBS staff members, many at our site and most at their own expense.

I have summarized in the written statement, Mr. Chairman, a number of these and other collaborations that will be evidence of this fact.

This type of cooperative effort with industries and universities working together with a national laboratory is precisely the approach recommended in the recent report of the panel of the White House Science Council on Federal Laboratories, chaired by Mr. Packard, and I would also suppose that it has been the intention of this committee and its predecessors that we should do that.

I do feel we do an excellent job in cooperating in this way. Indeed, we have a mission that encourages and clearly states how we are to cooperate.

The Automated Manufacturing Research Facility is a case in point. This facility is a unique research test bed we are using to develop the quality control techniques and the software interface standards needed for the unmanned factory of the future. Eight companies have loaned or donated capital equipment. We have a dozen research associates from various companies. There are 10 research contracts with universities, and in executing these contracts several faculty members and students are working at the site. The U.S. Navy has made a major financial investment in the program. The program, I believe, is a truly national collaboration in a major technology of precisely the kind that is being called for.

The NBS research reactor is another good example in the area of materials research. During the past year we have had over 150 collaborators at our reactor from 15 industrial firms, 22 universities, and 18 Federal organizations. We are proposing in our 1985 budget to design and develop a cold neutron source that will expand the capabilities of our facility and greatly increase the number of outside users.

The NBS research reactor is the only one in the United States that was specially designed to accommodate a large cold source. This multipurpose, multiuser addition is essential for advanced NBS research, and it will provide to industry a capability not otherwise available.

I'm very pleased to speak also about important changes taking place in the Institute for Computer Sciences and Technology. These changes are bringing about a much more harmonious relationship between ICST and the rest of NBS. ICST has become a very strong integral part of NBS, whether looked at from a mission standpoint or from the standpoint of technical program execution.

I see the national leadership ICST is providing in the standards area as impressive. They have successfully mobilized the interest of user groups such as the Network Users Association and the Association of Data Communications Users. They have been particularly effective in gaining the support of users and manufacturers in the development of computer network standards and in working with the International Standards Organization and the American National Standards Institute to develop technical specifications for standards and to test implementations of standards.

I am particularly delighted with the increase in laboratory facilities that ICST has established to support these testing programs and to investigate areas of new technology. We're also increasing the amount of basic research in ICST by providing competence funds in fiscal year 1984, and I believe this was a suggestion that was made by this Committee in your report last year, and the amount of that is $940,000 in fiscal year 1984.

Another area where important changes are occurring involves Standard Reference Data. The effects of computer and computer science offer new, cost-effective opportunities to provide more and better data in a form that can be disseminated to computerized design and manufacturing programs. Mathematical models, based on experimental data, will be coupled to computer-based dissemination systems and then to the computer-aided design/computer-aided manufacturing systems now used in industry.

In March we shall at the National Bureau of Standards host a 2-day workshop at which government, university, and industry participants will meet to discuss this new approach for providing evaluated data, suitably formatted for user systems of the future.

I'll now speak specifically about the 1985 budget. In fiscal year 1984, your committee authorized $125,485,000 for the National Bureau of Standards, and Congress appropriated $115,718,000. In fiscal year 1985, NBS is requesting an appropriation of $126,062,000. This request includes cost-of-living increases of $7,488,000, program increases totaling $17,874,000, and program decreases totaling $15,018,000.

I'm very pleased to be able to request substantial increases totaling $17,814,000 for some exciting new projects. We are asking for $3 million to meet the measurement needs for a new industry in the area of biotechnology, $2,500,000 to develop high priority measurement methods and standards for process and quality control, and $1,500,000 to provide the basic knowledge and design criteria needed to develop a world class cold neutron research facility that I mentioned earlier.

We are requesting an increase of $8,874,000 for the purchase of the much-needed class VI supercomputer to serve the computing needs of NBS as well as the NOAA/ Environmental Research Laboratory. There is also an increase of $2 million with which we will replace the antiquated telephone system at our Gaithersburg laboratory.

The budget calls for decreases of $3,174,000 in building research and $5,141,000 in fire research. These reductions will eliminate both centers. The budget includes a reduction of $5 million in the Institute for Computer Sciences and Technology. The measurement assurance program and the national voluntary laboratory accreditation program are to be decreased by $1,703,000.

I'd like to call your attention to the fact that Dr. Reneker is with me today as Acting Director of the Center for Materials Science. Last month I took the steps of making the Center for Materials Science a major operating unit of NBS, equivalent in the organization to the National Measurement Lab, the National Engineering Lab, and the Institute for Computer Sciences and Technology. This action is a result of materials science having become a subject of special attention in the administration and in the Congress; and a reflection of its growing industrial and academic importance, where it is increasingly managed as a separate entity.

The Center is a leading materials science institution with sufficient stature to stand side by side with other major operating units.

The proposed cold neutron research facility will be an integral part of that Center.

We have, as we have been going along with this, Mr. Chairman, kept your staff informed of these steps.

In my written statement I address several areas which have been of special interest and concern to the members of this subcommittee. I've already mentioned the budget increase for the purpose of the class VI supercomputer at NBS, and Dr. Lyons will have more to say on this subject in his testimony.

I would like to mention an area of special interest to you, Mr. Chairman, and also to your colleague, Mr. McKay. We have explored opportunities for expanding our interaction with the National Institute for Building Sciences [NIBS]. I met with the president of NIBS and in October 1983 signed an agreement with NIBS.

Under the agreement, NIBS will provide us with a priority list of building community research needs. NIBS is now preparing a work statement for this activity, and within the next few months we expect to award a contract for this work in fiscal 1984.

Another area of special interest to you, Mr. Chairman, has been cost recovery. During your markup of our bill last year you asked that we experiment with gradually moving toward cost recovery through user charges. We've taken steps in this direction, but it is too early to report any conclusive results. I am concerned about what we have observed so far. It appears that these increases could impair our ability to carry out our mission responsibilities.

We expect to have a detailed report on the impact of these increases to the Congress about May 1. In the meantime, I'm sure that either Mr. Kammer or Dr. Johnson can provide details of what we have learned so far.

I think that will conclude my oral remarks, Mr. Chairman.

I would like to add that the Secretary will be submitting draft legislation for our authorization in the near future.

I would be pleased, along with my colleagues, to answer any questions.

[The prepared statement of Dr. Ambler follows:]

U.S. DEPARTMENT OF COMMERCE
STATEMENT OF ERNEST AMBLER, DIRECTOR
NATIONAL BUREAU OF STANDARDS
BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
ON AUTHORIZATION OF APPROPRIATIONS FOR THE ACTIVITIES OF THE NATIONAL BUREAU OF STANDARDS

FEBRUARY 2, 1984

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I AM PLEASED TO APPEAR BEFORE YOU TODAY TO REQUEST AUTHORIZATION OF APPROPRIATIONS FOR THE PROGRAMS AND ACTIVITIES OF THE NATIONAL BUREAU OF STANDARDS (NBS) IN FISCAL YEAR 1985.

FIRST I WOULD LIKE TO INTRODUCE MY COLLEAGUES. I AM ACCOMPANIED BY MY DEPUTY DIRECTOR, MR. RAYMOND G. KAMMER; BY DR. DONALD R. JOHNSON, DIRECTOR OF THE NATIONAL MEASUREMENT LABORATORY (NML); DR. JOHN W. LYONS, DIRECTOR OF THE NATIONAL ENGINEERING LABORATORY (NEL); MR. JAMES H. BURROWS, DIRECTOR OF THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY (ICST); AND BY DR. DARRELL H. RENEKER, ACTING DIRECTOR OF THE CENTER FOR MATERIALS SCIENCE (CMS). DR. JOHNSON, DR. LYONS, MR. BURROWS, AND DR. RENEKER WILL SUMMARIZE THE ACTIVITIES, ACCOMPLISHMENTS, AND PLANS FOR THE ORGANIZATIONAL UNITS FOR WHICH THEY ARE RESPONSIBLE.

OVERVIEW AND PROJECTIONS FOR THE NATIONAL BUREAU OF STANDARDS

I WOULD LIKE TO OPEN MY TESTIMONY THIS MORNING BY READING TO YOU A SHORT PASSAGE WRITTEN BY THE COMMITTEE THAT REPORTED THE BILL TO ESTABLISH THE NATIONAL BUREAU OF STANDARDS. (REPORT NO. 1452, 56TH CONGRESS, 1ST. SESSION, MAY 14, 1900)

> "IT IS THEREFORE THE UNANIMOUS OPINION OF YOUR COMMITTEE THAT NO MORE ESSENTIAL AID COULD BE GIVEN TO MANUFACTURING, COMMERCE, THE MAKERS OF SCIENTIFIC APPARATUS, THE SCIENTIFIC WORK OF THE GOVERNMENT, OF SCHOOLS, COLLEGES, AND UNIVERSITIES, THAN BY ESTABLISHMENT OF THE INSTITUTION PROPOSED IN THIS BILL."

THIS PASSAGE, WRITTEN IN THE YEAR 1900, HAS BEEN SO SIGNIFICANT TO NBS THAT IT WAS CHISLED IN THE WALL IN THE LOBBY OF OUR GAITHERSBURG LABORATORY WHEN IT WAS COMPLETED IN 1965. THESE WORDS CONTINUE TO BE A CONSTANT REMINDER OF THE CONFIDENCE BESTOWED UPON OUR ORGANIZATION BY THOSE WHO CREATED IT. WE STRIVE TO REMAIN WORTHY OF THIS CONFIDENCE, ESPECIALLY NOW, WHEN THE NATION IS CALLING UPON INDUSTRY, UNIVERSITIES, AND GOVERNMENT TO INCREASE THEIR COOPERATIVE EFFORTS IN RESEARCH AND ITS APPLICATION TO ADVANCING TECHNOLOGY IN ORDER TO STRENGTHEN THE U.S. ECONOMY AND MEET THE INCREASING WORLD COMPETITION IN MANUFACTURING.

THE CHARGE BESTOWED UPON US IN 1900 IS EVEN MORE MEANINGFUL AND IMPORTANT TODAY, AND SO WE MUST DO EVEN MORE IN PLANNING, ORGANIZING

AND EXECUTING RESEARCH IN PROBLEM AREAS OF NATIONAL SIGNIFICANCE. ALL STAFF MEMBERS AT NBS, IRRESPECTIVE OF THEIR LEVEL IN THE ORGANIZATION, INTERACT WITH OUTSIDE INSTITUTIONS TO IDENTIFY AREAS IN WHICH TECHNOLOGICAL BARRIERS PREVENT PROMPT INTRODUCTION OF NEW AND COMPETITIVE TECHNOLOGIES IN U.S. INDUSTRY. WHEN THESE BARRIERS ARE RELATED TO A LACK OF MEASUREMENT METHODS, REFERENCE DATA, TEST METHODS, OR SIMILAR CONCEPTS, NBS TAKES THE LEAD ROLE IN EFFORTS TO BREAK DOWN THE BARRIERS. IN COOPERATION WITH INDUSTRY, WE ASSESS THE PROBLEM, DEFINE THE NECESSARY RESEARCH AND DEVELOPMENT, AND WORK WITH ALL PARTIES CONCERNED TOWARD SOLVING THE PROBLEM.

WE SEE AS MEASURES OF THE SUCCESS OF THESE EXTERNAL INTERACTIONS MANY SCIENTISTS AND ENGINEERS FROM OUTSIDE ORGANIZATIONS WORKING COOPERATIVELY WITH NBS STAFF MEMBERS, MANY AT OUR SITE AND MOST AT THEIR OWN EXPENSE. WE HAVE, FOR EXAMPLE

- 123 INDUSTRIAL RESEARCH ASSOCIATES,
- 325 VISITING FACULTY AND STUDENTS,
- 43 POSTDOCTORAL RESEARCH ASSOCIATES, AND
- 34 INTERGOVERNMENTAL PERSONNEL EXCHANGES.

IN ADDITION TO THESE PERSON-TO-PERSON INTERACTIONS WE PROVIDE EACH YEAR MANY OTHER WAYS FOR TECHNOLOGY TRANSFER, FOR EXAMPLE

- 1,500 TECHNICAL PUBLICATIONS,
- 2,500 TECHNICAL TALKS,

- 600 SEMINARS,
- 100 MAJOR CONFERENCES AND WORKSHOPS,

AND WE RECEIVE ANNUALLY

- 6,500 VISITORS, AND
- 47,000 PUBLIC INQUIRIES.

WE PROVIDE A RANGE OF SERVICES EACH YEAR, FOR EXAMPLE

- 7,000 CALIBRATIONS FOR 1,000 INDUSTRIAL LABORATORIES,
- 40,000 UNITS OF STANDARD REFERENCE MATERIALS,
- 5,000 QUERIES ANSWERED FOR STANDARDS AND CERTIFICATION INFORMATION,
- 110 OTHER FEDERAL AGENCIES SERVED THROUGH WORK WE PROVIDE,
- 470 STAFF MEMBERS IN VOLUNTARY STANDARDS ORGANIZATIONS.

PERSON TO PERSON CONTACTS WITH OUR EXTERNAL PROFESSIONAL COLLEAGUES ARE A WAY OF LIFE AT NBS. THIS TYPE OF COOPERATIVE AND COLLABORATIVE EFFORT, WITH INDUSTRIES AND UNIVERSITIES WORKING TOGETHER WITH A NATIONAL LABORATORY, IS PRECISELY THE APPROACH RECOMMENDED IN THE REPORT OF THE PANEL OF THE WHITE HOUSE SCIENCE COUNCIL ON FEDERAL LABORATORIES, CHAIRED BY DAVID PACKARD.

I believe we do an excellent job cooperating in this way and, indeed, we have a mission that encourages and clearly states how we are to cooperate. But we must do more. Thus we are encouraging an even greater use of our research facilities by outside institutions.

We are also taking other steps of which I would like to give just three examples. The first example has to do with public access to NBS research facilities such as the Automated Manufacturing Research Facility (AMRF) and the research reactor.

AUTOMATED MANUFACTURING RESEARCH FACILITY

The AMRF at NBS is an example of the kind of cooperative research we plan to encourage. The AMRF is a unique research test bed we are using to develop the quality control techniques and the software interface standards needed for the unmanned factory of the future. The facility has an unusually heavy involvement with industry, universities, and other government groups. Eight companies have loaned or donated capital equipment. We have a dozen Research Associates from various companies. There are ten research contracts with universities and in executing these contracts several faculty students are working at the AMRF. The U.S. Navy has made a major financial investment in the program. The program is truly a national collaboration on a major new technology.

RESEARCH REACTOR

THE NBS RESEARCH REACTOR IS A MAJOR NATIONAL FACILITY FOR COOPERATIVE RESEARCH IN MATERIALS CHARACTERIZATION. DURING THE PAST YEAR, WE HAVE HAD OVER 150 COLLABORATORS AT OUR REACTOR FROM 15 INDUSTRIAL FIRMS, 22 UNIVERSITIES, AND 18 FEDERAL ORGANIZATIONS. WE ARE PROPOSING IN OUR 1985 BUDGET TO DESIGN AND DEVELOP A COLD NEUTRON SOURCE THAT WILL EXPAND THE CAPABILITIES OF OUR FACILITY AND GREATLY INCREASE THE NUMBER OF OUTSIDE USERS. A COLD NEUTRON SOURCE WILL PROVIDE INTENSE BEAMS OF LONG WAVELENGTH NEUTRONS THAT ARE ABLE TO MEASURE THE INTERNAL STRUCTURE OF ADVANCED CERAMICS, NEW ALLOYS, AND IMPROVED CATALYSTS. BECAUSE NEUTRONS ARE VERY SENSITIVE TO HYDROGEN, THE NEW FACILITY WILL BE ESPECIALLY USEFUL IN MEASURING POLYMERS, POLYMER MATRIX COMPOSITES, AND LARGE BIOMOLECULES. THE NBS REACTOR IS THE ONLY ONE IN THE U.S. THAT WAS SPECIALLY DESIGNED TO ACCOMMODATE A LARGE COLD SOURCE. THIS PROPOSED MULTI-PURPOSE, MULTI-USER ADDITION, ESSENTIAL FOR ADVANCED NBS RESEARCH, WILL ALSO PROVIDE TO INDUSTRY A CAPABILITY NOT OTHERWISE AVAILABLE.

INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY

MY SECOND EXAMPLE DEALS WITH THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY (ICST). THERE HAVE BEEN A NUMBER OF CHANGES TAKING PLACE IN THE MANNER IN WHICH WE ARE EXECUTING THE PROGRAMS OF ICST. THESE CHANGES ARE ESPECIALLY SIGNIFICANT IN MY VIEW BECAUSE THEY HAVE GRADUALLY BROUGHT ABOUT, OVER THE LAST TWO YEARS OR SO, A MUCH

MORE HARMONIOUS RELATIONSHIP BETWEEN ICST AND THE REST OF NBS. ICST HAS BECOME A VERY STRONG, INTEGRAL PART OF NBS WHETHER LOOKED AT FROM A MISSION STANDPOINT OR FROM THE STANDPOINT OF TECHNICAL EXECUTION. I SEE THE NATIONAL LEADERSHIP ICST IS PROVIDING IN THE STANDARDS AREA AS IMPRESSIVE. THEY HAVE SUCCESSFULLY MOBILIZED THE INTEREST OF USER GROUPS SUCH AS THE NETWORK USERS ASSOCIATION AND THE ASSOCIATION OF DATA COMMUNICATIONS USERS. ICST HAS BEEN PARTICULARLY EFFECTIVE IN GAINING THE SUPPORT OF USERS AND MANUFACTURERS IN THE DEVELOPMENT OF COMPUTER NETWORK STANDARDS AND WORKING WITH THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) AND AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) TO DEVELOP TECHNICAL SPECIFICATIONS FOR STANDARDS AND TO TEST IMPLEMENTATIONS OF STANDARDS.

I AM ALSO DELIGHTED WITH THE INCREASE IN LABORATORY FACILITIES THAT ICST HAS ESTABLISHED TO SUPPORT THESE TESTING PROGRAMS AND TO INVESTIGATE AREAS OF NEW TECHNOLOGY. SOME OF ICST'S LABORATORY EFFORTS INCLUDE THE INVESTIGATION OF KNOWLEDGE BASED SYSTEMS TO ASSIST PROGRAMMERS IN DEVELOPING COMPUTER PROGRAMS AND THE DEVELOPMENT OF TEST METHODS AND PERFORMANCE MEASURES FOR COMPUTER AND NETWORK TECHNOLOGIES. THE TEST METHODS ARE ESSENTIAL TO ASSURE THE CORRECT PERFORMANCE OF THE PROTOCOLS IN A VARIETY OF NETWORKING ENVIRONMENTS. ONE SUCH TEST PROGRAM INVOLVES COMSAT WITH WHOM ICST PLANS TO TEST PROTOCOLS USING SATELLITE LINKS. WE ARE ALSO INCREASING THE AMOUNT OF BASIC RESEARCH IN ICST BY PROVIDING $700,000 OF COMPETENCE FUNDS IN FY 1984.

SCIENTIFIC TECHNICAL INFORMATION

My third example of steps we are taking to increase our cooperation with industry and universities involves Standard Reference Data. The effects of computer and computer science offer new, cost effective opportunities to provide more and better data, in a form that can be disseminated to computerized design and manufacturing programs. Mathematical models, based on experimental data, will be coupled to computer-based dissemination systems and then to the computer aided design/computer aided manufacturing (CAD/CAM) systems now used in industry. In March NBS will host a two-day workshop at which government, university, and industry participants will meet to discuss this new approach for providing evaluated data, suitably formatted for user systems of the future.

FISCAL YEAR 1985 BUDGET

In fiscal year 1984, the House Committee authorized $125,485,000 for NBS, and the Congress appropriated $115,718,000. In fiscal year 1985, NBS is requesting an appropriation of $126,062,000. This request includes cost of living increases of $7,488,000, program increases totaling $17,874,000, and program decreases totaling $15,018,000.

Today I am pleased to be able to request substantial increases totaling $17,814,000 for some exciting new projects. We are asking for $3,000,000 to meet the measurement needs for the chemical industry in the area of biotechnology, $2,500,000 to develop high priority measurement methods and standards for Process and Quality Control, and $1,500,000 to provide the basic knowledge and design criteria to develop a world class cold neutron research facility. We are requesting an increase of $8,874,000 for the purchase of the much needed Class VI Supercomputer to serve the computing needs of NBS as well as NOAA/Environmental Research Laboratory. There is also an increase of $2,000,000 with which we will replace the antiquated telephone system at the Gaithersburg laboratory.

The budget calls for decreases of $3,174,000 in Building Research and $5,141,000 in Fire Research. These reductions will eliminate both centers. The budget includes a reduction of $5,000,000 in the Institute for Computer Science and Technology. The Measurement Assurance Program (MAP) and the National Voluntary Laboratory Accreditation Program (NVLAP) are to be decreased by $1,703,000.

The proposed program reductions are made in the interest of focusing our limited Federal resources in areas that do not overlap with State and local responsibilities or private sector interests. Fire safety and building performance are the responsibility of state and local governments. Thus, it is our belief that the cost of necessary research for these and similar activities should be borne by them.

In the case of computer standards development, we propose to concentrate our efforts on international activities and to rely on our proven voluntary standards processes for addressing domestic ADP standards needs.

With respect to MAP and NVLAP, the proposed reductions are in keeping with our belief that when direct beneficiaries of services can be identified, they should bear the costs.

Further explanation of the program changes will be presented by the Major Operating Unit (MOU) Directors.

CENTER FOR MATERIALS SCIENCE

Before I proceed with our authorization request I would like to call to your attention the fact that Dr. Reneker is with me today as Acting Director of the Center for Materials Science. Just last month I took the step of making the Center for Materials Science a Major Operating Unit at NBS, equivalent in the organization to NML, NEL, and ICST. As you know, materials science is the subject of special attention in the Administration and Congress and materials work is increasingly managed separately in industry and universities. The Center is a leading materials science institution with a well deserved reputation for the high quality of its research output. For these reasons, I wanted the highest levels of Bureau management to be directly involved in the Center's programmatic decisions and priority setting. As I am sure you will hear in Dr. Reneker's testimony, that Center is heavily involved with industrial collaborations including a $4 million program with the

American Society for Metals for alloy phase diagrams, and has begun similar efforts in phase diagrams for ceramic and plastic materials. The proposed cold neutron research facility will be an integral part of the Center.

AUTHORIZATION REQUEST

The Secretary of Commerce will be submitting draft legislation which would, if enacted, authorize appropriations for NBS and the Office of Productivity, Technology and Innovation for fiscal year 1985.

Our draft bill would authorize a total NBS appropriation, exclusive of funding for salary adjustments, of $126,062,000 for fiscal year 1985. This includes $58,739,000 for Measurement research and standards; $19,561,000 for Engineering measurements and standards; $5,000,000 for Computer Science and Technology; $12,324,000 for Core measurement research for new technologies; $8,727,000 for the Technical Competence Fund; and $21,711,000 for Central Technical Support.

Our draft bill would authorize appropriations to the Secretary of Commerce of $600,000 for fiscal year 1985 for expenses incurred by NBS outside the United States in foreign currency in excess of normal requirements as determined by the Secretary of the Treasury.

Our bill would also authorize appropriation of $3,371,000 for fiscal year 1985 to the Secretary for the activities of the Office of Productivity, Technology, and Innovation. As I understand it, Dr. Bruce Merrifield, Assistant Secretary of Commerce for Productivity, Technology, and Innovation, will testify before you to describe the activities and programs of his Office on February 7.

AREAS OF SUBCOMMITTEE CONCERN

I would like now to discuss several areas which have been of special interest and concern to the members of this Subcommittee. I have already mentioned the budget increase for the purchase of the Class VI Supercomputer at NBS, and Dr. Lyons will have more to say on this subject in his testimony. Other areas include the NBS relationship with NIBS, the Recycled Oil Program, Measurement Standards for the Handicapped, and Weights and Measures.

NBS AGREEMENT WITH NIBS

Following up on the interests of the Committee expressed last year, we have explored opportunities for expanding our interactions with the National Institute for Building Sciences (NIBS). I met with the President of NIBS and in October 1983 signed an agreement with NIBS. Under the agreement, NIBS will provide NBS with a priority list of building community research needs. NIBS is now preparing a work statement for this activity. Within the next few months we expect to award a contract for this work in FY 1984.

RECYCLED OIL

In response to the Congressional mandate to develop test procedures for the determination of substantial equivalency of re-refined and new oil, Energy Policy and Conservation Act of 1975 (EPCA, Public Law 94-163; 42 U.S.C. 6201 et seq.), NBS investigated the use of recycled oil for both fuel and lubricant uses. NBS has established procedures for validating the use of recycled oil as a fuel. NBS has developed a strategy for validating the use of re-refined oil as a vehicular lubricant which will minimize the number of expensive engine tests required. This strategy, which was developed with the active cooperation of industry, ASTM and the U.S. Army, treats re-refined oil and virgin oil in the same manner. The strategy involves 8 low-cost consistency tests to show base stock consistency from batch to batch. Engine tests on 10 statistically selected oils, which are representative of both virgin and re-refined oils, are being completed this month. Early results of the engine tests show that the proposed validation strategy, namely the 8 consistency tests, is promising. By adopting the NBS study, the U.S. Army will be in an excellent position to specify its vehicular lubricant standards which are widely accepted in the private sector. This will put procedures necessary for validating the use of re-refined and virgin oil on the same basis and will have discharged NBS responsibility under the Energy, Policy and Conservation Act of 1975 as stated above. NBS' work has met the committee's expressed concerns that guidelines be published. The U.S. Army will revise and publish its authoritative specifications, based on NBS' work, for the use of re-refined oil as a vehicular lubricant.

MEASUREMENT STANDARDS FOR THE HANDICAPPED

NBS HAS BEEN ACTIVE IN FIVE DIFFERENT RESEARCH AREAS IN SUPPORT OF THE HANDICAPPED. WE ARE DEVELOPING METHODS FOR IMPROVING THE RELIABILITY AND INCREASING THE DURABILITY OF CERAMIC AND COMPOSITE PROSTHETIC DEVICES. WE ARE DEVELOPING METHODS FOR DETERMINING THE PERFORMANCE OF POLYMERS IN THE SYNTHETIC IMPLANTS INDUSTRY. WE ARE DEVELOPING MEASUREMENT METHODS AND REFERENCE MATERIALS FOR PREDICTING ALLOY FATIGUE AND CORROSION DURABILITY IN METALLIC ARTIFICIAL IMPLANTS. WE ARE DEVELOPING MEASUREMENT METHODS AND STANDARDS FOR IMPROVED X-RAY RADIOGRAPHY AND ULTRASONIC SCANNING TECHNIQUES APPLICABLE TO TISSUE, BONE, TEETH, AND SYNTHETIC IMPLANT MATERIALS. IN THE AREA OF FIRE RESEARCH WE ARE EXAMINING THE DEVELOPMENT AND SPREAD OF SMOKE AND TOXIC GAS IN BUILDINGS. THIS IS ESPECIALLY IMPORTANT WHERE PERSONS OF LIMITED MOBILITY ARE HOUSED. THE RESULTS OF THESE STUDIES WILL FURTHER OUR EFFORTS TO DEVELOP PROCEDURES FOR SAFE EVACUATION OF HANDICAPPED PERSONS IN BOARD AND CARE FACILITIES OR THE TRANSFER OF THESE PEOPLE TO SAFE AREAS OF REFUGE WHEN TIMELY EVACUATION IS NOT FEASIBLE.

WEIGHTS AND MEASURES

IN THE PAST SEVERAL YEARS NBS HAS REPROGRAMMED ITS FUNDING TO ALLOW INCREASED ACTIVITIES IN THE AREA OF WEIGHTS AND MEASURES.

We have broadened our support of the weights and measures program beyond the Office of Weights and Measures in specific areas of need at the state level. We have increased our support of the National Conference of Weights and Measures. We are providing technical support to the states for upgrading and expanding state laboratories. There are 49 states participating in the new State Laboratory Certification Program. We have initiated the development of a national training program including the impact of electronic technology. We have also established a national type evaluation program for new commercial devices. This last program is scheduled to begin in October of this year.

There are many other exciting and interesting programs in process at the National Bureau of Standards. You will hear more about a few of these in the testimonies that follow.

I look forward to working with this Subcommmitee in the future. I will be pleased to answer any questions you may have.

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234
OFFICE OF THE DIRECTOR

JANUARY 1984

ERNEST AMBLER, DIRECTOR

Dr. Ernest Ambler became the eighth Director of the National Bureau of Standards in February 1978. At the request of Secretary of Commerce Malcolm Baldrige, he has continued as Director for the Reagan Administration.

As Director of NBS, Dr. Ambler leads the Nation's measurement laboratory in the physical sciences and engineering. NBS directly supports the commerce, industry, and science of the Nation by producing and delivering measurement products and services. These products and services provide the basis for the exchange of goods, the accurate specification of products, quality control methods for production, and scientific advances. NBS contributes directly to the competitiveness of U.S. industry by maintaining and improving the Nation's measurement capabilities. The Bureau's headquarters are located in Gaithersburg, Maryland, with a second laboratory at Boulder, Colorado.

Dr. Ambler joined NBS in 1953, and has worked throughout his career to make NBS an increasingly valuable scientific and technical resource for industry, business, government, education, and the public. As a scientist, he has contributed directly to the state-of-the-art in measurement technology. His expertise in nuclear physics and cryogenics formed the basis in 1956 for a cooperative effort that disproved the law of parity conservation, a concept that nuclear scientists had adhered to for more than 30 years. This pioneering project confirmed experimentally the theoretical work of Nobel Prize winners T. D. Lee and C. N. Yang.

As an administrator, Dr. Ambler has helped guide Bureau operations and policies to improve the efficiency with which NBS fulfills its mission. His management responsibilities began in 1961 when he became Chief of the Cryogenic Physics Section. Four years later, he was appointed Chief of the Inorganic Materials Division. In 1968, as Director of the Institute for Basic Standards, he assumed responsibility for directing the most basic of NBS research activities: developing and maintaining standard and measurement techniques for such quantities as length, mass, time and frequency, and temperature.

In 1973 he was appointed Deputy Director of NBS, and Acting Director in 1975.

Among Dr. Ambler's continuing concerns is the Bureau's role in international science. He has long acknowledged that through its mission and diversity, the Bureau can act as a prime agent in international scientific cooperation and can support U.S. foreign commerce through participation in international standardization activities. In 1972, Dr. Ambler was elected to serve as the U.S. representative to the International Committee of Weights and Measures (CIPM), the executive body of the General Conference of Weights and Measures. In addition, he serves as chairman of that organization's Consultative Committee on Standards for Measuring Ionizing Radiation. In September 1981, he became the Department of Commerce member on the Board of Governors of the Israel/U.S. Binational Industrial Research and Development Foundation.

Dr. Ambler is a member of the American Association for the Advancement of Science, a fellow of the American Physical Society, and as Director of NBS, is ex officio President of the National Conference on Weights and Measures. He was commissioned by the Governor of Maryland in 1983 to serve on Maryland's High Technology Roundtable.

Dr. Ambler is the recipient of numerous honors, awards, and fellowships including: The Department of Commerce Gold Medal, the NBS Stratton Award, Nuffield Fellow of Oxford University, the John Simon Guggenheim Memorial Foundation Fellowship Award, the John Price Wetherill Medal of the Franklin Institute, the Washington Academy of Sciences Award, the Arthur S. Flemming Award, the William A. Wildhack Award, and the President's Award for Distinguished Federal Civilian Service. He has authored 52 publications and holds a patent for low temperature refrigeration apparatus and processes.

Born in Bradford, Yorkshire, England, in 1923, Dr. Ambler earned his B.A., M.A., and Ph.D. in physics at Oxford University before coming to the National Bureau of Standards. He became a United States citizen in 1958. Dr. Ambler and his wife, Alice Seiler Ambler, a former staff member in the NBS Heat and Building Research Divisions, were married in 1955. They live in Bethesda, Maryland, and have two sons, Christopher and Jonathan.

Mr. **Walgren**. Thank you, Dr. Ambler.

I'm wondering about formal testimony from the other members of your organization. Do each of you have written statements and an oral summary you can give us?

Dr. **Ambler**. Yes.

Mr. **Walgren**. Why don't we proceed with that, then, unless other members want to pursue questions at this point?

Let's proceed with the testimony, then, and for want of any better reason, we can go in the order that we have on our witness list, which starts second with Dr. Lyons, and then proceeds with Dr. Johnson, Director Burrows, Dr. Reneker, in that order.

Dr. Lyons.

STATEMENT OF DR. JOHN W. LYONS, DIRECTOR, NATIONAL ENGINEERING LABORATORY, NATIONAL BUREAU OF STANDARDS

Dr. **Lyons**. Thank you, Mr. Chairman. It's a pleasure, once again, to appear before the subcommittee and to discuss the programs of the National Engineering Laboratory.

I do have a formal, written statement which I would like to submit for the record.

The Engineering Laboratory provides technical services from the traditional engineering disciplines; namely, civil, mechanical, chemical, and electrical. We also provide mathematical services and support to the entire Bureau of Standards, and we are responsible for scientific computing support at the Bureau.

I'd like to touch on two or three special topics, and then I want to show, with your permission, some videotape of two technical highlights, and, finally, I will close with an approximately 3-minute videotape that the subcommittee has requested that I show from "Ripley's Believe It or Not."

First, I would like to endorse the concept of increased user facilities at the Bureau of Standards because I feel that the increased use of our facilities by outside parties, other agencies, university and industrial people, simply improves our ties and our relevance to our customers. Everything that I see and hear which suggests that we should do more of this I think is going to be of great benefit to the engineering program. After all, engineering research and engineering programs at the Bureau are driven by problems out there in the real world. So the closer the ties we have to the customer, the more effective our programs.

Second, I'd like to endorse with enthusiasm the proposal to replace our telephone system, not only because I'd like to have a more responsive telephone, but because this proposal will obtain for us an all-digital, nonblocking telephone system which will become part, among other things, of our computer network. It's a little more than just a telephone system.

Third, let me just say briefly in regard to the acquisition of the new scientific computer for NOAA's Environmental Research Laboratories and the Bureau of Standards, what the status is: We published the Request for Proposals in December 1983. There was originally a closing date for bids of late February. There were two requests for an extension. We granted one of thirty days so we'll now close late in March. There will then be the process of going through the benchmarking, witnessing the benchmarks, and various negotiations with the bidders. We expect to award the contract in the fall of this year, providing, of course, that we have the funds. The budget does contain an additional $8.9 million for that purpose.

If all of that should take place, then we would expect to install and start up the machine in the spring of 1985, with full qualification following in a few months' time. That's the current schedule, so we're still waiting for the closing of the period for bids.

The technical details of the programs of the Engineering Laboratory are in my written statement at considerable length, including highlights as well as projections.

As Dr. Ambler mentioned and you mentioned, Mr. Chairman, that the budget does propose the elimination of both the building research and fire research programs, the rationale simply being that fire safety and building performance have traditionally been the responsibility of State and local government, and, therefore, they should bear the cost of such programs.

Looking ahead, we see, first, more results coming from the Automated Manufacturing Research facility. I am going to show a little sample of videotape of that experimental test. I think over the next several years the committee will see many new and exciting results from that facility, which should have a considerable impact on our manufacturing industries.

And, second, we see no let up in the continuing revolution in electronics, moving beyond very large-scale integration into ultra-large-scale integration, going further into integrated optical electronics systems and, indeed, into wholly optical systems.

I recently had the pleasure of leading a team of NBS scientists through the laboratories of Nippon Telegraph and Telephone Public Corp., and we were deeply impressed and stimulated by the dedication of NTT to optical signaling, coherent signal processing, and the like. We see that this is a trend in this country as well, and we will be gearing up our programs to meet the measurement service needs for those areas.

Now, Mr. Chairman, with your permission, I'd like to show a couple of short excerpts of videotape. I would say before I begin that we have an approximately 15-minute videotape of the experimental run of the Automated Manufacturing Facility that occurred in late November, and I would like to give you a copy of that tape which you can view at your convenience. I understand you have a VCR. This is a VHS tape.

So we're just going to show a teaser from that tape this morning.

Then I have a very brief tape from Boulder, one of the facilities you saw—the near-field antenna measurement facility. I want to tie that to INTELSAT 6 for you very briefly.

That will conclude my testimony, but then I am asked to show the Ripley tape, which is not part of my testimony.

So, if we may, the monitor is on.

[Videotape is shown while Dr. Lyons narrates as follows:]

We begin with the run in November of the AMRF. You saw it a year ago. It now has a turning center on the right fed by a robot and the horizontal milling machine fed by a robot on the left, all tied together by a robot cart. This is the new robot that feeds the turning center. We come back to that.

The AMRF is now operated off a single central database. Here are some of the parts that can be made on demand.

This shows the Milacron robot and a view through the robot vision system which we've added since you saw the facility last. This is a picture through the eye of the robot.

The robot is in communication with the database and can check to see whether or not it has the right part and the right configuration. It can correct itself.

Now the robot cart moves to the turning station, a lathe, loaned by the way by Hardinge Brothers, and now we're showing an automatic setup with the feedstock. There's an overhead suspended robot that will come in, pick up a blank, take it over, and feed it to the machine. This part of the cell was not in place when you visited in February 1983.

Here we see the Bendix robot feeding the blank into the chuck.

This cell is the first that is able to do both milling and turning on a single part. As far as we know, it's the first time anywhere in the world where that's been done.

I might also point out that our interim graphics exchange specification, which is an interface standard, was successfully demonstrated this fall at Autofact 5, where a single geometric design was passed through 12 computer-aided design systems while maintaining fidelity of the part design.

Now I would like to switch to Boulder.

[Another videotape is shown while Dr. Lyons narrates as follows:]

This is INTELSAT 6, which is a very large satellite that is being built by Hughes. I'm sorry about the jitter. It's a 39-foot high satellite with very special antennas. It's crucial that the antennas be properly calibrated because they're designed to beam the signals at just certain parts of the world.

Hughes has decided to adopt our calibration scheme for these antennas, and you did see the near-field range.

Is that on hold, Sam [referring to the videotape]?

Well, in any case, Mr. Chairman, you viewed the near-field range, and Hughes and other manufacturers of these very high quality antennas, including phased-array antennas, are now using our technology.

We've got it going [referring to the videotape].

See the man in the picture. That shows the size of INTELSAT 6.

This is the range that you saw a few weeks back. That's a phased-array antenna.

There's a test probe on the right which goes up and down a track, and then the antenna can be rotated in two different directions. The test probe makes measurements of the radiated power of the antenna, and then that's all plotted up on a computer, so that you can see the pattern. We calculate from mathematical relationships what the pattern will be in the far field by this near-field measurement, so that one doesn't have to go outside to a large antenna range. Of course, you can't do that with a satellite.

OK, Sam, that's enough of that [referring to videotape].

That concludes my remarks, Mr. Chairman, but now I would like to show you, as soon as they can change the machine, 3 minutes from the Ripley program. Because this is a commercial film, I need to insert in the record a piece of paper which says that this segment called, "Instant Fire/Accident Research," is being shown with the permission of Mel Stuart, executive producer of Ripley's "Believe It or Not" television program.

So I'll give this for the record.

[Permission information to show videotape follows:]

Dr. Lyons. This was shown 2 or 3 months ago on national television.

[Whereupon, the segment from Ripley's "Believe It or Not," entitled, "Instant Fire/Accident Research," was shown.]

Dr. Lyons. Thank you, Mr. Chairman.

[The prepared statement of Dr. Lyons follows:]

U.S. DEPARTMENT OF COMMERCE
WASHINGTON, D. C. 20234

STATEMENT OF
JOHN W. LYONS, DIRECTOR
NATIONAL ENGINEERING LABORATORY
NATIONAL BUREAU OF STANDARDS
BEFORE THE
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
ON AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1985
FEBRUARY 2, 1984

U.S. DEPARTMENT OF COMMERCE

STATEMENT OF
JOHN W. LYONS, DIRECTOR
NATIONAL ENGINEERING LABORATORY
NATIONAL BUREAU OF STANDARDS

BEFORE THE

SUBCOMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
ON AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1985

FEBRUARY 2, 1984

Mr. Chairman and Members of the Subcommittee: It is a pleasure for me to appear before this Subcommittee to discuss the programs of the National Engineering Laboratory of the National Bureau of Standards.

Introduction

The National Engineering Laboratory (NEL) conducts technical programs in the traditional engineering areas - civil, mechanical, electrical, and chemical - and in applied mathematics. We are also responsible for providing computing services to the Bureau. The engineering programs provide to industry, state and local governments, and other Federal agencies, these services: engineering data, measurement procedures, calibrations and special tests, new test methods, and research results developed in support of these services. All of our activity requires close collaboration with the customer. In the past year these relations have intensified as shown by increasing numbers of visiting scientists and research associates and by other forms of cost-sharing by industry in our work. We are promoting and encouraging these collaborations. We are strongly supportive of the moves to encourage establishment of National user facilities at NBS and to permit more use by industry of certain NBS measurement facilities. These actions will strengthen linkages to both universities and industry and will increase the already considerable flow of outside technical people through our laboratories. Finally, we are most anxious to see the new telephone system installed because as an all-digital system it will become a very flexible and key component of our NBS computer network. We hope all these concepts will be realized soon.

A highlight of the year for me was leading a delegation of NBS technical people on a detailed review of the laboratories of the Nippon Telegraph and Telephone Public Corporation (NTT) as part of an Administration program to stimulate exports to Japan. We were very impressed with the technical expertise of NTT, particularly in optical signal processing and in integrated communications systems. We are now exploring several options for cooperative work with NTT.

We are carrying out a special assignment to secure a new central scientific computer system to serve both NBS and the Environmental Research Laboratories of NOAA. I am happy to report that we issued the request for proposals (RFP) for the computer hardware in mid-December. This will include a supercomputer. We hope to award the contract in October 1984 and install the machines by spring 1985. This is of course contingent on the appropriation of the $8.9M shown in the FY 1985 NBS budget.

In FY 1984 we are conducting our programs according to the following headings as set forth in the budget: building research, signals and systems metrology, chemical engineering metrology, mathematical sciences, technical reimbursable services, semiconductor program, automated manufacturing, and fire research.

I would now like to describe these major programs and highlight some recent accomplishments.

ENGINEERING MEASUREMENT AND STANDARDS SUBACTIVITY

This part of the NBS budget includes NEL's building research, signals and systems metrology, chemical engineering metrology, mathematical sciences, and technical reimbursable services. NEL's portion of this subactivity was funded in FY 1984 at $18,340,000 (331 positions). In FY 1985 the budget will be reduced to $16,239,000 (282 positions). The reduction is primarily due to the elimination of the building research program.

Building Research

The Administration's FY 1985 budget proposes to terminate this program with a budget reduction of $3,174,000 (41 positions) in order to avoid duplication of responsibilities that are more properly the role of state and local governments. In FY 1984 other agencies are expected to support additional building research activities at a level of $8.7 million.

The NBS Center for Building Technology serves as the national building research laboratory. It conducts laboratory, field and analytical research to develop technologies for the prediction and measurement of the performance of building materials, components, systems and practices. Current studies include new technologies for effective use of advanced computation and automation in the building process, structural and geotechnical engineering, quality assurance and durability of building materials, performance of thermal envelope, lighting and acoustical systems, building control systems, and heating, ventilating, and air conditioning systems. The Center performs much of its work through cooperative research agreements with other Federal agencies.

The Center also has responsibility for the development of seismic design and construction provisions in the National Earthquake Hazards Reduction Program. We work with the Federal Emergency Management Agency (FEMA), the U.S. Geological Survey, and the National Science Foundation in this effort. FEMA has designated NBS to chair the Interagency Committee on Seismic Safety in Construction. The Committee's work focuses on practices for buildings, lifelines, and site hazard assessment, and policies for Federal domestic assistance, lease and regulatory programs. We also are providing technical support to the private sector's Building Seismic Safety Council in its trial designs of representative buildings nationwide, analyses of design results, and formulation of recommended nationally applicable seismic design and construction provisions.

NBS and the National Institute of Building Sciences (NIBS) have recently developed an agreement that will strengthen their already effective cooperation for the improvement of building technologies and practices. NIBS will develop a list of priority research needs for consideration by NBS in the formulation of its building and fire research programs. NIBS will be informed of NBS's programs in building research and building-related fire research through reports and presentations. NBS will participate in NIBS activities to keep informed of their programs and research needs.

The Center has a major new research thrust in computer-integrated construction. We are learning how to express building standards and codes in machine readable form and logic. We are doing this work with Carnegie Mellon University. We are currently developing techniques to make design standards and specifications modular, interchangeable elements in computer-aided design (CAD) to avoid obsolescence of CAD software when standards are changed. We are doing this with the University of Illinois at Urbana. We are extending the Initial Graphics Exchange Specification (IGES), developed for the discrete parts manufacturing industry, to the construction industry. IGES will allow the exchange of geometrical and nongeometrical data between the files and graphics equipment of various construction organizations without revealing proprietary software.

Recent accomplishments of the NBS building research program include the following:

o The new ANSI A58 standard, "Minimum Design Loads for Buildings and Other Structures," incorporating our recent work on structural loadings and reliability, mentioned in last year's testimony, is in the process of being incorporated in the Building Officials Conference of America's model building code.

o We studied the failure mechanisms of masonry walls under earthquake loadings using the newly-commissioned, NBS three-dimensional loading facility. These results will provide the basis for design criteria for safe and economical masonry construction in seismic areas.

o We developed an ASTM draft standard on nondestructive methods for predicting the in-place strength of concrete in structures under construction. These test methods will assist contractors in the safe and timely removal of form work.

Signals and Systems Metrology

In FY 1984 this program was funded at $5,804,000 (105 positions). The FY 1985 budget continues this program at $6,210,000 (111 positions). Reimbursable support for the program in FY 1985 is planned at about $7.6 million, including calibration fees.

In our Signals and Systems Metrology program we address measurements of signals that are intentionally acquired, processed, and transmitted in digital computer and control systems and communications systems; we devise means of measuring signals that are unintentionally emitted by electronic systems which cause hazards to the proper functioning of other systems and also means of assessing the immunity of systems to such interference; and, we address measurements that bear on the transmission of electrical power and the materials needed in such systems.

Electronics and communications technology is moving very rapidly. Our technical efforts to provide calibration services, measurement techniques and standards, and supporting fundamental research are driven by requirements for broader dynamic signal ranges, new spectral regions, shorter time scales, higher data rates, higher complexity, and higher accuracy. I shall mention some developments that give a perspective on the nature of our work:

- INTELSAT, the international corporation established to operate communications satellites, has selected our near-field antenna measurement techniques for performance-testing of antennas to be flown on INTELSAT 6.

- We have developed a portable isotropic magnetic field meter for the measurement of various high-power radio frequency sources including broadcast antennas and industrial sealers, dryers, and induction heaters. This survey tool offers wide frequency coverage and power ranges in a convenient portable package. The protection of personnel and equipment from electromagnetic exposure rely on accurate measurement tools in the workplace environment.

- We developed the first national noise standard in the millimeter-wave domain of the frequency spectrum. This 94-GHz cryogenic noise standard will permit industry and other agencies to further the development and evaluation of critical components for millimeter-wave systems. This standard represents a major step toward the successful use of millimeter waves for communications, defense, and aerospace applications.

- We developed a large-area, fast silicon detector for optical-to-electrical conversion with a response time of less than 50 picoseconds. This detector will aid industrial development of high-bandwidth components for exploitation of the full advantages of optical fibers.

Advanced electronic and optical technologies, with capabilities beyond today's silicon technology, will emerge as the subject of intense international competition. We are beginning to lay the groundwork for the characterization and measurement methods required for these ultra-high performance electronics, and opto-electronic and optical signal processing systems.

Chemical Engineering Metrology

In FY 1984 this program was funded at $4,136,000 (72 positions). The FY 1985 budget continues this program at $4,424,000 (77 positions). Reimbursable support for the program in FY 1985 is expected to be about $5.7 million.

This program provides U.S. industry with measurement services and data bases which make possible improved innovation, design, and control of chemical processes; help assure equity in domestic and international trade; and strengthen the competitiveness of U.S. industry in the world market. We develop new measurement methods, calibrate instruments, measure properties of compounds and mixtures of compounds, and provide predictive engineering relationships useful in the design and control of chemical processes. We conduct a significant basic research program - both theoretical and experimental - in support of these technical services. I will describe some of the past year's major accomplishments.

- We received two IR-100 awards. This award, sponsored by Industrial Research Magazine, recognizes, each year, the 100 most significant new technological developments in the United States.

  - The first was for the development of a pyrometer with microsecond resolution. This unique instrument measures the temperature of rapidly heated metal specimens at high temperatures (2000 - 6000K) at the rate of about ten thousand measurements per second. The measurements have high temperature industrial applications and are important to defense, aerospace, and nuclear reactor safety.

  - The second was for the development of the high temperature optical fiber thermometer which I described to you last year.

- We developed a new, improved, equation of state for the thermodynamic properties of steam. The International Association for Properties of Steam (IAPS) has provisionally accepted this equation of state as a new international standard. IAPS tables are used for the design of chemical process plants, nuclear reactors, and electrical power generation plants.

- We have constructed and are now operating a slurry flow facility for predicting the behavior of the solid component in solid-liquid slurry flows. This understanding is of critical importance in measuring the amount of solids in industrial process streams, such as coal in oil, coal in water, and paper pulp in water. There is relatively little of a fundamental nature known about flow in these multiphase systems. The information we are gathering will aid in the design and control of a variety of future power generation and chemical processing plants.

- We completed two new volumes of a liquefied natural gas (LNG) manual which covers various aspects of measurements for custody transfer. Properties of LNG, measurement techniques, and methods for determining the accuracy of the measurement process are provided. This manual will be published during this calendar year.

As part of a multi-year program funded by the Gas Research Institute, we conducted mass flow measurements on orifice plate flowmeters. These flowmeters are used to measure most of the billions of dollars worth of natural gas transported in international and domestic pipelines. The performance data gathered thus far confirm that metering anomalies exist. These findings were presented in June to the International Gas Research Council in London. We plan to determine the cause of the anomalies and to develop improved equations for more accurate flow measurements.

We are developing improved thermophysical properties data for supercritical extraction processes. This work is funded by a consortium of nine private firms, the Gas Processors Association, and the DOE. An equation of state and mathematical models for carbon dioxide and other potential extracting fluids are being developed. The data will be used for commercial exchange of carbon dioxide, by industry to develop improved oil recovery methods, and for potential new supercritical extraction processes.

Mathematical Sciences

In FY 1984 this program was funded at $5,226,000 (88 positions). The FY 1985 budget continues this program at $5,605,000 (94 positions). Reimbursable support for the program in FY 1984 and FY 1985 is planned at about $1 million.

The Mathematical Sciences program provides support in mathematical modeling, statistics, data analysis, systems analysis, and computing to the engineering and scientific programs of NBS and to some clients in other Federal agencies. This program develops mathematical methods in a host of mathematical subdisciplines. The Center also provides technical assistance for NBS laboratory automation, operates the NBS NET (which links computers, word processors, and terminals throughout NBS) and operates the central computer.

The Center for Applied Mathematics engages in extensive collaborations with the NBS scientific staff. Two accomplishments from these collaborations are:

o Work with the Fire Research program has further developed the mathematical model of a fire evolving in a room to a 3-dimensional time dependent version that can be efficiently displayed on a dynamic computer graphic system. The display of smoke particles in the flow field has provided new insights into the dynamic features of the flow field.

- Work with the Metallurgy Division has developed an interactive, computerized data base management system for archiving alloy phase diagrams using a novel data structure. This will provide easy, economic, and time-saving accessibility to the latest research data required in the manufacture of semiconductors and metal alloys.

Over the next several years the Center will continue to concentrate on the mathematical and computing needs of the NBS researchers. New and increased dependence on computers, from mainframes to microprocessors, will require software appropriate for the research community. The Center will continue to acquire and adopt software packages for NBS use. The internal training and educational activities will become even more important to insure effective use of computers.

Technical Reimbursable Services

This program is totally supported on a reimbursable basis and includes funding of about $3.6 million in FY 1985 for both the NBS Office of Energy-Related Inventions (OERI) and the NBS Law Enforcement Standards Laboratory (LESL). OERI evaluates inventions for technical validity, potential energy impact, and commercial feasibility and also conducts activities aimed at stimulating technological innovation by independent inventors and small business. LESL conducts research and provides technical services to assist State and local governments in procuring equipment suitable for the needs of law enforcement agencies.

CORE MEASUREMENT RESEARCH FOR NEW TECHNOLOGIES SUBACTIVITY

The Core Measurement Research for New Technologies Subactivity includes NEL's Semiconductor Program and Automated Manufacturing Research Program.

Semiconductor Program

In FY 1984 this program was funded at $5,199,000 (79 positions). The FY 1985 budget continues this program at $5,523,000 (84 positions). Reimbursable support for the program in FY 1985 is expected to be approximately $600,000.

Very Large Scale Integrated (VLSI) circuits continue to promise major advances in computing and information processing at ever lower cost per function for applications of impressive scope. However, the full promise of VLSI cannot be realized without overcoming major technical challenges that give rise to difficult measurement-related problems. VLSI circuits are more sensitive to impurities in the starting materials. They require higher-resolution lithographic techniques for fabrication, and they utilize highly complex circuits whose performance will be difficult or impossible to test comprehensively.

The following developments give an idea of the nature of our work in this area:

o We completed the sixth and seventh seminars on the NBS-developed technique of measuring linewidths on photomasks used in the fabrication of integrated circuits. Over 300 representatives from more than 90 organizations have now been trained. Virtually every U.S. manufacturer of integrated circuits and the optical equipment used to make them has participated in our seminars and uses our new techniques or physical standards. This methodology enabled a ten-fold improvement in the performance of relatively inexpensive equipment used for photomask linewidth measurements.

o The Electrical Industries Association (EIA) has adopted the NBS-developed technique for measuring the operating temperature of MOSFETs (metal oxide-semiconductor field-effect-transistors) as a preferred procedure and has included the technique in the EIA Handbook on Power MOSFETs. MOSFETs are an increasingly important technology for power semiconductor devices.

o We have collaborated with several manufacturers of integrated circuits to yield improved test structures and procedures for measuring selected properties of integrated circuits, such as contact resistance. The semiconductor industry and other government agencies widely use NBS-developed integrated circuit test structures to characterize integrated circuit fabrication processes, to evaluate the effectiveness of semiconductor processing equipment, to obtain crucial parameters for device and process models, and for product acceptance.

During the next three years we will develop improved measurement methods for deep-level defects and impurities whose presence can degrade semiconductor properties. To aid in evaluating integrated circuit quality, we will address four categories of measurements: for critical steps in the fabrication process, for the quality of critical circuit element design, for the quality of circuit packages and their thermal characteristics, and for the functional performance of finished circuits using considerably less than 100 percent testing.

Automated Manufacturing Research

This program includes Automated Manufacturing Interface Standards, Mechanical Engineering Metrology, and Automated Manufacturing Research Facility. In FY 1984 these programs were funded at $6,154,000 (93 positions). The FY 1985 budget continues this program at $6,101,000 (98 positions). Appropriated funds were reduced by $1,649,000 in FY 1984, but the program is not being adversely affected because we found other sources of support. We are benefiting from equipment loans from the private sector, research associates and visiting scientists, and substantial increased support by other Federal agencies, notably the U.S. Navy.

The Automated Manufacturing Research Program continues to pursue its two goals: a measurement system capable of providing traceability to national standards in a fully automated environment and an infrastructure which will support interface standards that allow incremental implementation of automation especially by smaller firms.

Our first interface standard in this field has been adopted as a U.S. national standard, has been proposed as an international standard, and has been adopted and demonstrated by 12 leading manufacturers in the computer-aided design field giving us hope that our goal of compatibility between units of different manufacturers will indeed reach the level of compatibility of a modular home stereo system. I will describe some of the past year's major accomplishments.

o The first test run of the AMRF was successfully held in November 1983. A horizontal machining center, a turning center, and a materials handling system operated under high level computer control with a host of software interfaces. This was the first time that a part requiring both milling and turning has been made in a flexible manufacturing system. As part of our five-year program with the Navy, we operated a number of robots, machine tools, computer controllers, and sensor systems, all from a variety of manufacturers, as an integrated manufacturing system.

o We have 12 Research Associates from private industry and researchers from 10 universities working at NBS in this program. About $800,000 worth of equipment in the AMRF has been loaned or donated to NBS by private industry.

o Much progress has been made in expanding the capabilities of the Interim Graphics Exchange Specifications (IGES), a software interface standard. At the November 1983, Autofact 5 Conference, 12 of the largest vendors of computer-aided design and computer-aided manufacturing equipment joined NBS in a working demonstration of the transfer of part files between different systems using IGES. The three-dimensional geometry of a complicated mechanical part was transferred between systems without error.

The automation program is ahead of schedule and will be producing more and more results in the next two years. We shall see more software interface standards and the metrology of the factory of the future will take shape.

FIRE RESEARCH SUBACTIVITY

The Administration's FY 1985 budget proposes to terminate this program with a budget reduction of $5,141,000 (40 positions). The intent is to avoid duplication of responsibilities by performing work that is more properly the role of state and local governments. In FY 1984 other agencies are expected to support additional fire research activities at a level of about $3.2 million.

The Center for Fire Research provides technical information needed by manufacturers and the standards and codes communities to reduce fire losses and the costs of fire protection. The Center conducts basic research on fire phenomena; develops scientifically-based models, measurement methods and data; and works closely with many other private and public sector organizations to translate these findings into new engineering practices, test methods and proposals for improved standards or code provisions. The Center currently sponsors most of the academic research on fire in the U.S. with $2 million annually applied to some 25 research grants. The Center is the central U.S. fire research laboratory. It conducts work for many Federal agencies on a reimbursable basis and draws on the capabilities of international counterpart laboratories, e.g., in Canada, England, France, and Japan.

Major developments in basic fire research are enabling important strides towards fire simulation and prediction methods for more effective fire protection.

- Progress continues in developing scientifically-based engineering methods for predicting a building's vulnerability to fire. We developed a framework for the integration of fire growth models and test results and applied it to a hypothetical high-rise hotel. Joint efforts are planned with fire protection industry groups to assure an orderly transition to the use of this powerful new tool.

- Significant progress continues towards delivering practical methods for assessment of the hazard arising from smoke toxicity. A computer-based smoke transport model and associated computer graphics have been developed. Full-scale validation tests are currently underway. Improved measurement methods of the toxicity of combustion products are currently being developed and a new instrument is being fabricated. We seek to understand the relative contribution of a specific product or material to the overall life hazard for a specified fire situation. This will, in turn, show the effectiveness of alternative approaches to reduce fire smoke hazards.

- We completed an evaluation of the effectiveness of automatic sprinklers and smoke detectors in residences and nursing homes for saving lives. Private sector support is being sought to interpret and disseminate this information to builders, developers, planners, architects, building owners and users to facilitate commercialization of improved technology for life-safety fire protection.

- Nearly five years of research, laboratory and field tests have resulted in practicable computer-based models and technically-sound design guidelines for practicing engineers and architects. The American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) has adopted, published, and is disseminating this information as the Smoke Control Handbook. Smoke control systems can limit the spread of smoke from fires, provide for smoke-free safety for escape/rescue in stairwells, and serve to remove smoke safely from a burning building.

o We constructed a cone-calorimeter, a small scale device that measures the rate at which energy is released during the combustion of a small piece of, for example, a chair or a mattress. This is the energy that drives the growth of fire from small to large, from a single chair to an entire room or building. These data and mathematical models now under development, will help manufacturers and designers to create furnishings of reduced fire hazard.

Mr. Chairman, this concludes my prepared testimony. I shall be pleased to answer any questions you, or other members of the Subcommittee, may have.

JOHN W. LYONS

Date of Birth: November 5, 1930

Birthplace: Reading, Massachusetts

Education: Degrees

Harvard University, A.B., Chemistry
1952
Washington University, A.M., Physical Chemistry
1963
Washington University, Ph.D., Physical Chemistry
1964

Positions:

Director
National Engineering Laboratory
National Bureau of Standards

As Director of the National Engineering Laboratory Dr.Lyons is responsible for NBS's research in applied mathematics, building technology, electronics and electrical engineering, energy conservation, engineering standards development, fire, manufacturing engineering and chemical engineering.

From April to December 1983 Dr. Lyons served as the Acting Deputy Director of the National Bureau of Standards.

Dr. Lyons was Director of the NBS Center for Fire Research until December 18, 1977, and was responsible for providing scientific and technical knowledge applicable to the prevention and control of fires.

Dr. Lyons served in various research and development positions at the Monsanto Company from 1955 to 1973. He specialized in the chemistry and uses of phosphorus-based chemicals including fire retardants. He served from 1971 to 1973 as a member of the ad hoc panel of fire research, a National Academy of Sciences evaluation panel for the National Bureau of Standards.

Dr. Lyons is author of two books: Viscosity and Flow Measurements and The Chemistry and Uses of Fire Retardants. He has contributed chapters to five other books and has written numerous papers and articles on technical or research topics. His early research interest was the physical chemistry of polyeletrolyte solutions, especially formation of complexes with metal ions. This work emphasized the behavior of inorganic polyphosphates and desoxy ribonucleic acid (DNA).

Dr. Lyons is a Fellow of the American Association for the Advancement of Science, Fellow of the Washington Academy of Science, member of the American Chemical Society (past chairman of the St. Louis Section), member of the American Institute of Chemical Engineers and member of Sigma Xi. He serves on the Advisory Committee for Engineering, National Science Foundation; Advisory Council, College of Engineering, University of Maryland; Board of Directors, National Fire Protection Association. He is serving on a special committee of the Maryland State Board for Higher Education to study the needs for engineering education. He was chairman of the Products Research Committee (1974-1979), a nine-member charitable trust administering a $5M research fund on fire research; co-chairman of the US-Japan Natural Resources Panel of Fire Research (1975-1978). He received the Presidential Management Improvement Award in 1977 and the US Department of Commerce Gold Medal, also in 1977. In 1981 he received the Presidential Rank Award of Distinguished Executive.

Mr. WALGREN. Well, I appreciate your bringing that piece back. I think I saw it on television when they presented it, and it certainly is dramatic and in many ways an investment in itself.

Let's go to the next witness, then, and we'll continue through the list.

Apparently, the minority has a group meeting of some kind, and they are not boycotting today but will be along as time allows. I'm hoping that they will be able to be here before we finish the testimony.

But let's go, then, to Dr. Johnson.

STATEMENT OF DR. DONALD R. JOHNSON, DIRECTOR, NATIONAL MEASUREMENT LABORATORY, NATIONAL BUREAU OF STANDARDS

Dr. JOHNSON. Thank you, Mr. Chairman, Mr. Brown, and members of the subcommittee.

I'm really happy to be here with you this morning to discuss the programs and budgets of the National Measurement Laboratory at NBS.

I'd like to present you with a brief summary of the important budget issues in our area this morning, if I may, and then I'd like to submit my full testimony for the record.

The National Measurement Laboratory is involved with research in the traditional disciplinary areas of physics and chemistry. We are responsible for the primary standards of mass, length, time, temperature, electric current, radiant intensity that form the basis for measurement.

Our research leads to improved understanding of fundamental atomic, molecular, and nuclear radiation processes, and our laboratories provide the Nation with state-of-the-art measurement services in many areas of chemistry.

We also manage the three basic service delivery programs: Standard reference materials, standard reference data, and calibrations. These delivery programs represent the means by which sophisticated measurement technology developed in all areas at NBS is transferred to the tens of thousands of large and small users in industry, State, and Federal laboratories.

The laboratory currently has a total staff of about 900. Six hundred and seventy-five are full-time equivalent employees, and the balance are guest workers, industrial research associates, and academic people.

Our budget for fiscal year 1984 includes approximately $36.5 million in appropriated funds and an estimated $22 million in reimbursement of services, to give an expected total for the year of $58.5 million.

Mr. Chairman, before I turn to the budget issues, I'd like to take just a few moments to share just one of our many technical accomplishments of the past year with you. There are several other accomplishments that are included in my written statement and also in the budget document itself.

This morning I'd like to talk to you about trace chemicals. The effects of trace chemicals, both beneficial and harmful, have become a matter of intense interest to nutritionists and pathologists in their search for clear linkages between diet and health. Through our frequent involvement with international and national committee activities, the College of American Pathologists, World Health Organizations, and organizations of the like, we have become aware that measurements of chemical constituents at trace levels in body fluids, tissues, and foodstuffs are subject to enormous errors.

During the past year we have used our unique analytical chemistry expertise and specialized facilities to develop new techniques for measuring several of these important elements. One of these elements, chromium, is thought to be an important factor in insulin metabolism associated with diabetes. We are at the present time certifying new standard reference materials, such as water, human serum, urine, and powdered milk, which contain chromium as well as other elements at the parts-per-million to parts-per-billion levels. These standards will be soon made available to thousands of industrial, hospital, and Government laboratories to insure the quality of difficult and important measurements.

Mr. Chairman, I relate that example to you because it's tied very closely to a proposed budget increase that we have for fiscal year 1985.

I'd now like to turn our attention to the various areas of the budget where we're proposing increases.

We are proposing an increase of $3 million and 28 positions to expand our facilities and expertise in special areas of chemistry and physics to address the measurement needs emerging from the industrialization of biotechnology.

Biotechnology is entering a stage which requires solid scientific base with expertise in physical sciences as well as the biological sciences. Smaller firms, and even some of the larger organizations, are very hard-pressed to marshal the resources that are necessary to deal effectively with the physical measurement problems associated with their own biological research and development activities. Many of these firms have already approached NBS for help with measurement of biomolecules and the understanding of their chemical activity.

Mr. Chairman, I'd like to emphasize that biotechnology is an area where the U.S. industry has a significant technical lead. I understand that point was emphasized by Dr. Keyworth yesterday. This is also an area, I think, where the economic prospects for growth are very good. In fact, bioengineered products are already appearing in the pharmaceutical and clinical chemistry markets.

NBS has a very well-established expertise in clinical chemistry, and we have marketed standard reference materials to this community for more than 15 years.

We are proposing to build on this base of experience and to expand resources to provide information on the mechanisms of enzyme catalysis, thermochemical data on biomolecules, new physical and chemical measurement methods, and new standard reference materials.

We are also proposing an expansion of $2.5 million and 20 positions in the area of process and quality control for high technology industries. Here the focus will be on the development of new calibration services that are aimed specifically at high priority requirements that have been identified in cooperation with the National Conference of Standards Laboratories.

Better quality control and improved capability for adhering to more demanding specifications are desperately needed by the high technology defense and manufacturing industries. Expanded measurement capability is also required in medical applications such as radiation therapy, as well as in many other areas such as vacuum and leak rate determinations.

NBS is ready to provide the technical leadership that is necessary in all of these areas, but new resources are needed to develop new services here.

Now in an effort to reduce costs and to recover the costs of specific services from those who benefit directly, we propose a decrease in our request for direct appropriation by the amount of $1.25 million in the subactivity involving measurement assurance programs or MAP's. This is a decrease in the same area as was proposed last year.

MAP's involves transfer of measurement technology at the highest levels of accuracy, and they serve a smaller number of users who have such specialized needs. These are expensive services to develop, and they must be based on an existing and well-documented calibration service. So MAP's and calibrations are really tied together.

Past practice has been to use appropriated funds for MAP research and development, and then to recover the incremental costs of delivery of the service through charges to the customers. We now propose to develop only those new MAP's that direct beneficiaries are willing to pay to support. NBS will, of course, continue to provide existing MAP services to the maximum extent possible under this new funding program.

Mr. Chairman, those are the points I wanted to make for you orally. I'd be very happy later in the morning to answer questions for you.

[The prepared statement of Dr. Johnson follows:]

U.S. DEPARTMENT OF COMMERCE
STATEMENT OF DONALD R. JOHNSON, DIRECTOR
NATIONAL MEASUREMENT LABORATORY
NATIONAL BUREAU OF STANDARDS
BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
ON AUTHORIZATION OF APPROPRIATIONS FOR THE ACTIVITIES OF
THE NATIONAL BUREAU OF STANDARDS

FEBRUARY 2, 1984

Mr. Chairman, Members of the Subcommittee:

I'd like to thank you for the opportunity to meet with you today to describe the research services, accomplishments, and plans of the National Measurement Laboratory of the National Bureau of Standards.

The National Measurement Laboratory is responsible for the development and dissemination of the national physical and chemical standards of measurement to meet the needs of science, industry, commerce, and government. This is a multifaceted responsibility which requires scientific competence and experimental facilities to conduct state-of-the-art measurements in diverse areas of physical and chemical science. For example, we conduct research at the frontiers of physics which leads to improved realization of the basic physical quantities that underlie measurement science -- mass, length, time, temperature, electric current and radiant intensity. Our research also leads to improved understanding of fundamental atomic, molecular and nuclear radiation processes. Our laboratories provide the Nation with state-of-the-art measurement services in the areas of thermodynamics, transport properties, chemical kinetics, surface science, molecular spectroscopy, and chemical analysis.

The National Measurement Laboratory currently employs a staff of 675 full-time equivalent employees plus another 230 guest workers, industrial research associates and academic persons who contribute to our research programs. Our appropriated budget under the subactivity, Measurement Research and Standards, in fiscal year 1984 is $32.6 million and we anticipate another $21.8 million for reimbursable services, including services to other agencies, sale of Standard Reference Materials and calibration services.

The National Measurement Laboratory manages, and is a major contributor to, the three basic NBS service delivery programs -- Standard Reference Materials, Standard Reference Data, and Calibrations. These services represent the means by which sophisticated measurement technology developed at NBS is transferred to the tens of thousands of large and small users in industry, state, and Federal laboratories. To ensure effective priority setting for our research services, as well as timely technology transfer, we maintain close liaison with industry groups, government agencies, professional associations, and standards bodies.

Mr. Chairman, I would now like to outline a few of the many recent accomplishments of our Laboratory to illustrate the nature of the work we do, the kind of services we deliver, and the contribution these services make to public benefit.

Recent Accomplishments

The surface and near-surface distribution of chemical species in materials often determines their performance in service. Many high-technology materials are prepared using processes involving chemical implantation, surface coating, or surface treatments to control the location of chemical species. These processes represent a chemical tailoring of the surface layers to produce special properties required in high-performance applications. To characterize these materials, as well as to evaluate the costly processes used to produce them, sensitive new methods are needed for measuring the chemical composition -- on and below surfaces. During the past year -- in cooperation with researchers from industry, universities, and other national laboratories - we have developed new techniques for measuring chemical depth distributions. These techniques, based upon ion-surface collisions and neutron interactions with atoms on and beneath surfaces, offer very promising approaches for both destructive and non-destructive monitoring. Based upon this work, we recently introduced a new line of Standard Reference Materials, the first of their kind in the world. These standards will directly assist U.S. industry to ensure the reliability of measurements used in the development, quality assurance, and trade specifications for advanced materials.

The effects of trace chemicals -- both beneficial and harmful -- has become a matter of intense interest to nutritionists and pathologists in their search for clear linkages between diet and health. Through our continuous involvement with international and national committee activities, we have become aware that measurements of chemical constituents at trace levels in body fluids, tissues and foodstuffs are subject to enormous errors, thus confounding efforts to set public policy or regulatory guidelines. During the past year, we have used our unique analytical chemistry expertise and specialized facilities to develop new techniques for measuring several of these very important elements. One of these elements, chromium, is thought to be an important factor in insulin metabolism which is associated with diabetes. We are at the present time certifying new Standard Reference Materials, such as water, human serum, urine and powdered milk which contain chromium as well as many of the other elements at the parts per million to parts per billion levels. These standards will be made available to thousands of industrial, hospital, and government laboratories to ensure the quality of difficult and important measurements.

During the past year we have given high priority to improving the cost effectiveness, range, and quality of the calibration services we provide to industrial laboratories. These services are used to ensure the reliability of the apparatus these laboratories use to test the performance of the instruments and devices they produce. Through automation and personnel reassignments we have greatly reduced turnaround time to our customers, offered several new electrical calibration services, new measurement quality assurance training seminars, and improved the accuracy of the primary pressure standard. Improved accuracy in our pressure standard translates into improved performance of a wide variety of devices such as aircraft altimeters, indicators for speed, yaw, pitch, and so on -- which must be carefully calibrated on a regular basis. Here again, we have worked closely with industry scientists to ensure the appropriateness, timeliness, and effectiveness of technology transfer.

Unique radiation facilities have long been a cornerstone of NBS operations. These facilities serve our in-house staff in their calibration and research efforts and are also available to guest workers, postdoctoral fellows, visiting faculty, and industrial research fellows for collaborative research with NBS staff.

Our synchrotron ultraviolet radiation facility (SURF) is the best calibrated ultraviolet light source in the U.S. During the past year NBS scientists have made a direct comparison of the radiation from SURF with both of our standard lamps and our standard semiconductor diode detectors. In this three- way comparison we were able to achieve excellent agreement, establishing an accuracy base in radiation measurements that may well have implications upon the International Practical Temperature Scale. The radiation from SURF is also used to provide calibrations for other Federal agencies such as NASA, which require extremely high accuracy for the optical instruments used in space shuttles and space telescopes. The University of Maryland, working with the Naval Research Laboratory, is installing a special spectrometer at SURF to pursue joint research interests with NBS staff. Our surface scientists have found SURF to be ideally suited for investigating adsorbtion and desorbtion of molecules on surfaces in order to better understand catalysis processes. Over the years, SURF has proved to be a truly universal instrument serving both standards and research needs.

NBS has operated a linear electron accelerator at our Gaithersburg site for almost 18 years. As I mentioned to this Committee last year, we are developing a new prototype continuous wave electron accelerator with funding provided by the Department of Energy. This unique developmental project is being carried out jointly with Los Alamos National Laboratory and, when completed in mid 1986, will provide NBS with a truly state-of-the-art replacement for our current linear accelerator. We will be able to use this new accelerator to provide better calibration services for medical applications of radiation now used in many hospitals. The accelerator will also provide NBS and other U.S. scientists with a forefront nuclear physics research facility that will be unique in the country until at least 1990.

The Laboratory proposes program expansions in two areas for Fiscal Year 1985:

We propose an increase of $3 million and 28 positions to expand our facilities and expertise in specialized areas of chemical and physical measurement to address the needs emerging from the industrialization of biotechnology. This technology is entering a stage which will require a stronger scientific foundation, and, compared with other high-technology areas, a more diversified or multidisciplinary effort. Smaller firms, and even some larger organizations, will be hard pressed to marshall the resources necessary to deal effectively with the measurement problems associated with research and development activities. Many of these firms have already approached NBS for help in theoretical and experimental areas involving the measurement of biomolecules and the understanding of their chemical activity.

At the present time, U.S. industry has a commanding technical lead in biotechnology, and prospects for economic growth are promising. The pharmaceutical industry has already felt a significant impact from new bioengineered products with new markets projected in excess of $2 billion by 1990. NBS has a well established expertise in the closely related and rapidly growing area of clinical chemistry. We propose to build on this base of experience, and, with expanded resources, will provide information on mechanisms of enzyme catalysis, thermochemical data on biomolecules, new physical and chemical measurement methods and Standard Reference Materials. We will assist U.S. industry in optimizing biochemical processes, improving analytical techniques and quality control, and in selecting and designing better biocatalysts.

We also propose an expansion of $2.5 million and 20 positions in the area of Process and Quality Control for other high-technology industries. Here the focus will be on the development of new physical measurement and calibration services aimed specifically at high priority requirements identified in cooperation with the National Conference of Standards Laboratories. The increasing use of precision electronic instrumentation and test equipment pervades the high technology, defense and manufacturing industries. Better quality control and improved capability for adhering to more demanding specifications are desperately needed by these industries. Expanded measurement capability is also required in medical applications such as radiation therapy, as well as in many other areas such as vacuum and leak rate determinations. NBS can provide the technical leadership in all of these areas, but new resources are needed to develop and maintain new services. An independent panel of industrial and government experts have reviewed our priorities, and endorsed our plans and approach.

In efforts to reduce costs and to recover the costs of specific services from those who benefit directly, we propose to decrease our request for direct appropriation for fiscal year 1985 by the amount $1.25 million in the subactivity involving measurement assurance programs (MAP). In previous years these resources have been used to support the research and development required to establish new measurement assurance programs and to transfer these services to users. MAP's involve transfer of measurement technology at the highest levels of accuracy and serve a smaller number of users who have such specialized needs. These are expensive services to develop, often requiring several years of research before a new service can be offered. Past practice had been to use appropriated funds for the MAP research and development, and then, through participation fees, to recover the incremental costs of delivery of the service. We now propose to develop only those new MAPs that direct beneficiaries are willing to support fully. NBS will continue to provide existing MAP services to the maximum extent possible under the new funding plan.

The National Measurement Laboratory is committed and dedicated to serving the Nation in the most effective ways possible. We will continue to promote the development of high quality science and technology in the United States through provision of measurements, standards, and data. We stand ready to act as a third party in technical disputes, and to assist those making technical and scientific decisions.

Mr. Chairman, this concludes my formal presentation. I would be happy to respond to any questions you or any Members of the Subcommittee may have.

Dr. Donald R. Johnson
Director, National Measurement Laboratory
National Bureau of Standards

Don Johnson was appointed Director of the National Measurement Laboratory in March 1983. He is responsible for the development and maintenance of the scientific competences and experimental facilities necessary to provide the United States with a central basis for uniform physical and chemical measurements, measurement methodology, and specifications of properties that determine the performance of materials.

Dr. Johnson began his career at NBS in 1967 as a physicist performing basic research on the development of instrumentation and techniques for studying short-lived molecules in complex chemical systems for application in physics, chemistry, aeronomy and radioastronomy. Dr. Johnson has been directly involved in numerous radio telescope observations and participated in the discovery of several new interstellar molecules.

In 1976, he served as Program Analyst in the Office of the NBS Director where he analyzed and evaluated scientific and technical programs in the context of Bureau, Departmental, and Administration policy and provided recommendations to the NBS Director on basic standards and fundamental physics activities within NBS.

Dr. Johnson became Deputy Director for Programs in the National Measurement Laboratory in 1978 to provide direction for the matrix managed Programs of the Laboratory, and in 1980 was appointed Deputy Director for Resources and Operations where he directed the five major technical Centers of the Laboratory.

Dr. Johnson received a Bachelors Degree in Physics from the University of Puget Sound in 1960, a Masters Degree in Physics from the University of Idaho in 1962, and a PhD in Physics from the University of Oklahoma in 1967. He has authored (or co-authored) over 60 original scientific papers and presented many invited talks.

Dr. Johnson has received numerous awards, including both Silver and Gold medals from the Department of Commerce, the Arthur S. Flemming Award and the Senior Executive Service Meritorious Award.

He serves on the Board of Directors of the American Society for Testing and Materials. He chairs the ASTM Standing Committee on the Voluntary Standards System. Dr. Johnson also represents the Divison of Chemical Physics on the Council of the American Physical Society. He is a member of the American Association for the Advancement of Science, the American Astronomical Society, the International Astronomical Union, and the Sigma Xi.

Mr. **Walgren**. Thank you, Dr. Johnson.

Let's turn to Director Burrows.

STATEMENT OF JAMES H. BURROWS, DIRECTOR, INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY, NATIONAL BUREAU OF STANDARDS

Mr. **Burrows**. Mr. Chairman, members of the committee, I want to thank you for inviting me to speak here today.

I submitted my official written testimony to the subcommittee, and that statement, I believe, contains all the facts that you want to know about us. I request that it be entered in the record.

In the time I have now I would like to highlight some of the areas covered in the longer statement and try to give you a feel for my institute, to try to convey why, despite the turmoil of the last few years, we've been able to maintain a highly competent technical staff. Those of us who believe that we are doing important, useful work appreciate the opportunity to serve our Nation.

There are three areas I'd like to talk about: Our technology transfer activities, our computer security and risk management activities, and our laboratory facilities.

Our technology transfer activities were spurred by the Stevenson-Wydler Act, which mandates that Federal laboratories spend a portion of their budget to transfer technology to State and local governments and to private industry. In an attempt to comply with the spirit of that act, we've established a State and local planning group with about 25 members from all over the country.

Quarterly, we schedule a large telephone conference call and discuss topics of interest to all of us. We are finding that, as this process matures, local government members have asked their neighbors to sit in. The topics of these conferences, however, are selected by the participants, and depending on the topic, either we, ICST, plan and implement the agenda, or one of the other participants does so. In all cases we foot the bill for the FTS telephone line and the administrative work supporting it.

Up to now we have led the teleconferences on local area networking, office systems, and the effects of the AT&T divestiture on ADP planning.

The city of Baltimore led a teleconference on institutional cable networks, and New Orleans was a leader on geoprocessing.

From that, you can see that technology transfer is not necessarily a one-way street. There are many areas in which ICST is unquestionably the leader, local area networking for instance, but other areas like institutional cable networks are beyond our scope of expertise, and we learned a great deal both from Baltimore's and New Orleans' presentation.

Transcripts of each teleconference are made available to members of URISA, the Urban and Regional Information Systems Association, and are distributed to all the State data processing units through the National Association of State Information Systems.

We're not satisfied that this activity is giving us broad enough coverage, and we're currently investigating the possibility of using the National Public Radio's direct broadcasting satellite to broaden the audience.

I do not have time now to describe our teleconferencing activities with industry, except to mention that a system similar to the State and local one is under development, and we recently had a conference with over 30 participants for the purpose of explaining the structure of the voluntary standards arena to large corporate ADP users.

I'd like to move now to our computer security and risk management programs. Because of the recent news stories about computer breakins by hackers, computer security is one of the hot topics of the day, to the extent it's even reached "Bloom County" in the funny papers. While the topic may be newly hot, the problem has been with us for some time, and the problem includes more than just intentional or juvenile breakins. The risk from accident or just simple negligence is equally important. Obviously, we recognized that problems existed in the security area long before the production of the movie, "War Games," and our security programs are not new to ICST.

In 1977, before ICST received expanded funding that permitted us to address a larger part of our mandate, we had issued the data standard encryption for use by the Federal Government. This standard was recently adopted by the American National Standards Institute as a voluntary industry standard and is being recommended by the American Bankers Association to the banking industry for international use.

Since that time, two of our staff members have received a U.S. patent for their work on the key notarization system, and we have issued a series of guidance documents for the Federal Government and are in the process of developing further guidance.

In this area we are the nondefense agency that has a program, addressing the overall computer security problems and area source of expertise for the civilian agencies.

Requests for our services are going to increase as new technologies which give more people access to computer networks take hold. The influence of the new technology combined with the hacker headlines have already resulted in a significant increase in help costs, and these have not come just from Federal agencies, who are our primary clients, but from all over the country.

Just within the past few months our security and risk management people have engaged in tech transfer activities with, among others, the State of Florida, both the legislative and executive branches; the Southern California Chapter of the Society for Information Management; the New England Chapter of the ADP Auditors Association; and we have testified on this subject before several committees of both the U.S. House of Representatives and the Senate.

One might ask, why us? Well, understandably, the Federal agencies turned to us because our specific mandate is to help them, but our expertise is in demand by others outside the Federal Government for a number of reasons.

First, we have close and continuing ties with the defense security community, and we are recognized as the technical transfer agent for security solutions developed by that community.

Second, we have a close and continuing tie with the private sector. The bankers, I believe, testified at hearings last year. We generally know what the private sector problems are, what solutions have been developed, and what potential solutions are under development. We are the natural, I think, technology transfer agent.

Finally, we are in demand because we're good, we're competent. That statement leads me to the final highlight, our laboratory facilities.

Computer security cannot be considered in the absence of computer technology; that is, it's not just a matter of making a policy decision. The decision must be implemented on real computers communicating over real networks.

If expertise is to be developed and utilized, there must be access to a variety of systems and to a variety of hardware and software, so that the areas of vulnerability can be probed and implementation alternatives tested.

ICST has about a dozen laboratories, each addressing a different aspect of computer and communications technologies. For instance, we have a Data Base Management Lab, a Software Engineering Lab, a lab that works with high speed networks, and so on. Each of these aspects addressed by a lab implies a potential security vulnerability. The availability of our laboratory facilities and the personnel who work in them give our security and risk management staff the opportunity to develop and maintain the expertise that underlies their reputation as the best in the business. In fact, it's our laboratories that give us and our clients confidence in all of our advice and allows us to demonstrate our competence to the world.

I'd like to conclude by mentioning that I had a hard time selecting the contents of this talk.

One of the painful missions has been our work in international network standards because that work is very important to our international trade position.

I finally decided to stick with the highlights included because I think they are aspects of our work that you may not have heard much about before.

We would certainly welcome you and your staff out to ICST again, and I would be pleased to answer any questions on any aspect of the program now.

Thank you.

[The prepared statement of Mr. Burrows follows:]

U.S. DEPARTMENT OF COMMERCE

STATEMENT OF JAMES H. BURROWS
DIRECTOR, INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY
NATIONAL BUREAU OF STANDARDS

BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U. S. HOUSE OF REPRESENTATIVES
ON AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1985

FEBRUARY 2, 1984

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I AM JIM BURROWS, DIRECTOR OF THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY, AND I THANK YOU FOR INVITING ME TO SPEAK TO YOU TODAY. I WOULD LIKE TO REPORT BRIEFLY ON THE CURRENT STATUS OF ICST AND THEN HIGHLIGHT SOME OF OUR RECENT ACTIVITIES. I WILL BE HAPPY TO ANSWER YOUR QUESTIONS.

THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY HAS BUDGET AUTHORITY OF $10.0 MILLION FOR THE CURRENT FISCAL YEAR. WE ARE CONTINUING TO FOLLOW THE COMMITTEE'S DIRECTION TO SUPPORT RESEARCH AND STANDARDS IN AREAS THAT ARE IMPORTANT FOR MAINTAINING A U.S. COMPETITIVE POSITION IN INTERNATIONAL TRADE. WITH ADDITIONAL FUNDING PROVIDED BY NBS, WE HAVE INITIATED THREE NEW COMPETENCE PROJECTS: TESTING PROTOCOLS IN GLOBAL COMMUNICATIONS NETWORKS; INVESTIGATION OF KNOWLEDGE BASED SYSTEMS FOR SOFTWARE DEVELOPMENT; AND PERFORMANCE

EVALUATION OF SUPERCOMPUTERS. ALL OF THESE PROJECTS ARE DIRECTED TOWARD AREAS OF EMERGING TECHNOLOGY AND FUTURE APPLICATIONS.

WE HAVE RESTRUCTURED OUR STANDARDS DEVELOPMENT ACTIVITIES AND WE HAVE STEPPED UP OUR EFFORTS TO ASSESS THE IMPACT OF NEW TECHNOLOGY AND TO TRANSFER INFORMATION AND TECHNOLOGY TO GOVERNMENT AND INDUSTRY. COMPUTER TECHNOLOGY IS BEING INTEGRATED INTO MANY NEW FUNCTIONAL AREAS IN GOVERNMENT AND THE PRIVATE SECTOR. WE ARE EXPERIENCING, AS A RESULT, INCREASED REQUESTS FOR INFORMATION, TECHNICAL ASSISTANCE AND GUIDANCE IN MANAGING AND USING MICROCOMPUTERS AND SMALL SYSTEMS, DISTRIBUTED PROCESSING, DATA MANAGEMENT TECHNOLOGY, AND SECURITY TECHNOLOGY.

BECAUSE COMPUTER TECHNOLOGY IS BASIC TO SO MANY GOVERNMENT, SCIENTIFIC, BUSINESS AND CONSUMER ACTIVITIES, WE HAVE A BROAD CONSTITUENCY TO SERVE. WE CONTINUE TO WORK WITH MANY DIFFERENT GROUPS TO TRANSFER TECHNOLOGY, TO SHARE INFORMATION ABOUT WHAT WE ARE DOING, AND TO LEARN FROM OTHERS. EXAMPLES OF THESE ACTIVITIES INCLUDE THE SUCCESSFUL TELECONFERENCE SERIES THAT WE STARTED LAST YEAR FOR STATE AND LOCAL GOVERNMENTS. THESE TELECONFERENCES WHICH SERVE GROUPS OF USERS THROUGHOUT THE COUNTRY ARE ORGANIZED TO COVER A SINGLE TOPIC IN DEPTH AT EACH SESSION. RECENT SESSIONS HAVE DEALT WITH NETWORKING, OFFICE AUTOMATION, AND THE AT&T DIVESTITURE. TWO TELECONFERENCES HAVE BEEN HELD FOR INDUSTRY PARTICIPANTS, THE MOST RECENT ONE ONLY A FEW DAYS AGO WAS DEVOTED TO A DISCUSSION OF VOLUNTARY STANDARDS

PROGRAMS. WE CONTINUE TO WORK CLOSELY WITH INDUSTRY AND GOVERNMENT ORGANIZATIONS IN COOPERATIVE TESTING PROGRAMS. MORE THAN 120 ORGANIZATIONS VOLUNTEERED TO PARTICIPATE WITH US TESTING NETWORK PROTOCOLS. THE BANKING AND AUDITING COMMUNITIES ARE COOPERATING WITH US IN DEVELOPING COMPUTER SECURITY SAFEGUARDS. WE PROVIDE TECHNICAL SUPPORT TO OTHER UNITS OF GOVERNMENT RESPONSIBLE FOR POLICY DEVELOPMENT ON COMPUTER AND TELECOMMUNICATION ISSUES. OUR FORECAST OF FUTURE INFORMATION TECHNOLOGY, PRODUCED BY A CONSORTIUM OF FEDERAL AGENCIES WORKING TOGETHER, IS USED BY FEDERAL AGENCIES AND THE PRIVATE SECTOR. FOREIGN VISITORS, INCLUDING INFORMATION SCIENTISTS AND GOVERNMENT OFFICIALS FROM JAPAN, KOREA, AUSTRALIA, AND OTHER COUNTRIES ASKED FOR BRIEFINGS ON OUR ACTIVITIES AND VISITED OUR LABORATORIES.

DURING THE PAST YEAR, WE ISSUED ABOUT 20 PROPOSED, COMPLETED AND REVISED FEDERAL INFORMATION PROCESSING STANDARDS (FIPS), AND ABOUT 25 INFORMATION, RESEARCH AND GUIDANCE DOCUMENTS. ABOUT 100 FIPS AND SEVERAL HUNDRED OTHER REPORTS ARE CURRENTLY AVAILABLE TO GOVERNMENT AND INDUSTRY. OTHER MEANS THAT WE USE TO TRANSFER INFORMATION AND TECHNOLOGY ARE CONFERENCES, WORKSHOPS, SEMINARS, AND BRIEFINGS. WE SPONSORED WITH THE MAJOR PROFESSIONAL ORGANIZATIONS, 6 LARGE NATIONAL CONFERENCES ON SUBJECTS SUCH AS SOFTWARE ENGINEERING, ARTIFICIAL INTELLIGENCE, AND MICROPROCESSOR USE. WE HAVE HELD 15 MAJOR SEMINARS AND WORKSHOPS TO IDENTIFY PROBLEMS AND POTENTIAL SOLUTIONS IN APPLYING NEW TECHNOLOGY. TWO EXAMPLES ARE A

WORKSHOP ON OPTICAL DIGITAL DATA DISK TECHNOLOGY AND ONE ON LINKING MICROCOMPUTERS TO MAINFRAMES. WE PARTICIPATED IN HUNDREDS OF MEETINGS--BRIEFING FEDERAL AGENCIES, USER GROUPS, AND OTHER PROFESSIONAL GROUPS, AND WE PARTICIPATED IN NATIONAL AND INTERNATIONAL STANDARDS DEVELOPMENT GROUPS. OUR EXPECTED FUNDING FOR FY 1984 INCLUDES $3 MILLION THAT WE WILL RECEIVED FROM OTHER FEDERAL AGENCIES TO PROVIDE DIRECT TECHNICAL ASSISTANCE FOR SPECIFIC PROJECTS. AGENCIES CALL ON US TO SOLVE TECHNICAL PROBLEMS DEALING WITH COMPUTER SECURITY, DATA MANAGEMENT TECHNOLOGY, NETWORKING, AND DATA COMMUNICATIONS. SOME OF OUR LARGER CURRENT PROJECTS ARE FUNDED BY THE DEPARTMENT OF DEFENSE, THE DEFENSE NUCLEAR AGENCY, THE SOCIAL SECURITY ADMINISTRATION, AND NASA.

TO SUMMARIZE OUR RECENT ACTIVITIES, I WILL DESCRIBE BRIEFLY FIVE AREAS THAT ILLUSTRATE THE DIVERSITY OF OUR PROGRAMS AND THE DIFFERENT GROUPS THAT WE SERVE: TECHNICAL ADVICE AND ASSISTANCE RELATED TO COMPUTER SECURITY; ASSESSMENT OF NEW TECHNOLOGY; SUPPORT TO INDUSTRY VOLUNTARY STANDARDS EFFORTS; APPLIED RESEARCH AND DEVELOPMENT; AND OUR INTERNATIONAL NETWORKING PROGRAM.

FIRST, WE HAVE RECEIVED MANY REQUESTS FOR TECHNICAL ASSISTANCE RELATED TO COMPUTER SECURITY DURING THE PAST YEAR. THIS ISSUE HAS BEEN IN THE SPOTLIGHT AS MANY STORIES OF BREAK-INS TO COMPUTER SYSTEMS WERE REPORTED BY THE MEDIA. WE TESTIFIED OR PREPARED STATEMENTS ON OUR COMPUTER SECURITY ACTIVITES FOR THE HOUSE SMALL BUSINESS AND SCIENCE AND TECHNOLOGY COMMITTEES, AND FOR THE SENATE GOVERNMENT AFFAIRS COMMITTEE. THIS PAST JUNE WE ORGANIZED A SEMINAR ON NETWORKING AND security with the Florida Joint Select Committee on Electronic Data Processing of the Florida Legislature. State and local government users and vendors participated in the workshop. Last month, two staff members briefed another committee of the Florida Legislature, the Joint Committee on Information Technology, on computer security issues.

Our computer security program emphasizes the need for increased awareness of the vulnerabilities of computer and communication systems. These vulnerabilities include not only intentional attacks but also accidental errors and events that are a source of greater loss today than computer related crime or mischief. Because there are a broad range of problems, a broad range of administrative procedures and technical solutions are needed to safeguard computers and data from losses of all types. Many of these solutions are available today, and many are an integral part of an overall approach to managing ADP.

Our emphasis is on getting the needed procedures and technology into the hands of the user. We have been working with the staff of the Department of Defense's Computer Security Center to transfer the technology being developed for defense applications to the civilian side of government, and to the private sector. For example, we recently hosted the sixth workshop on computer security with DoD. The workshops have been well attended by both government and industry.

CURRENTLY, WE ARE THE ONLY NON-DEFENSE AGENCY THAT HAS A PROGRAM ADDRESSING THE OVERALL COMPUTER SECURITY PROBLEM AND POTENTIAL SOLUTIONS.

WE HAVE ALSO BEEN WORKING CLOSELY WITH VOLUNTARY INDUSTRY GROUPS TO DEVELOP NEEDED SECURITY STANDARDS AND GUIDELINES. ONE AREA IN PARTICULAR THAT I WOULD LIKE TO HIGHLIGHT IS THE DEVELOPMENT OF DATA ENCRYPTION TECHNIQUES TO PROTECT DATA THAT IS TRANSMITTED BETWEEN TERMINALS AND COMPUTERS OR BETWEEN COMPUTERS IN A NETWORK. THE DATA ENCRYPTION STANDARD (DES) THAT WE ISSUED IN 1977 WAS RECENTLY ADOPTED BY THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) AS A VOLUNTARY INDUSTRY STANDARD AND IS BEING RECOMMENDED BY THE AMERICAN BANKERS ASSOCIATION TO THE BANKING INDUSTRY FOR PROTECTING ELECTRONIC FUND TRANSFERS. WE RECENTLY COMPLETED A REVIEW OF THIS STANDARD, AND BASED ON GOVERNMENT AND INDUSTRY COMMENTS, HAVE REAFFIRMED IT FOR A FIVE-YEAR PERIOD.

THE DES HAS BEEN INCORPORATED BY THE COMPUTER INDUSTRY INTO A VARIETY OF HARDWARE DEVICES. ICST OPERATES A VALIDATION SERVICE ENABLING MANUFACTURERS TO GAIN CERTIFICATION THAT THEIR DES PRODUCTS OPERATE IN CONFORMANCE WITH THE STANDARD.

TWO OF OUR STAFF MEMBERS RECEIVED A U.S. PATENT FOR THE WORK THAT THEY DID TO DEVELOP A KEY NOTARIZATION SYSTEM (KNS). THIS SYSTEM IS THE ELECTRONIC EQUIVALENT OF THE NOTARY PUBLIC PROCESS FOR LEGAL DOCUMENTS. THE KNS SEALS BOTH THE SECRET KEYS THAT ARE NEEDED FOR

THE ENCRYPTION PROCESS AND USER PASSWORDS WITH AN ELECTRONIC IDENTIFICATION. AS A RESULT OF THIS PROCESS, THE PARTIES TO A TRANSACTION CAN NEITHER CREATE A FAKE MESSAGE NOR DENY THE SENDING OF AN AUTHENTICATED MESSAGE.

THE KNS PROVIDES A SIGNATURE CAPABILITY WHICH ENABLES THE RECEIVER OF INFORMATION TO PROVE THAT THE MESSAGE WAS INDEED SENT BY THE IDENTIFIED SENDER. THE BANKING INDUSTRY IS VERY INTERESTED IN APPLYING THESE TECHNIQUES TO ELECTRONIC BANKING AND IS WORKING WITH US TO DEVELOP THE NEEDED IMPLEMENTING SOFTWARE.

THE SECOND AREA IS OUR ASSESSMENT OF NEW TECHNOLOGY, A SUBJECT WHICH THIS COMMITTEE HAS ADDRESSED FREQUENTLY IN THE PAST. WE ARE WITNESSING A DRAMATIC CHANGE IN GOVERNMENT AND INDUSTRY AS THE USE OF DESK TOP COMPUTERS AND OTHER SMALL SYSTEMS INCREASES. THE WORK ENVIRONMENT IS CHANGING FROM ONE IN WHICH INFORMATION IS COLLECTED, PROCESSED, AND DISTRIBUTED BY ADP SPECIALISTS TO ONE IN WHICH THE END-USERS COLLECT AND PROCESS THEIR OWN INFORMATION. TO HELP ORGANIZATIONS ANALYZE AND MANAGE THE CHANGES THEY ARE EXPERIENCING, WE HAVE DEVELOPED A PROGRAM OF TECHNICAL SUPPORT THAT INCLUDES ASSESSMENTS OF THIS TECHNOLOGY AND ITS USES, AND WAYS THAT ORGANIZATIONS CAN SUPPORT THEIR SMALL COMPUTER USERS.

WE CONDUCTED A SIX-MONTH STUDY OF THE EXPERIENCES OF FEDERAL AGENCIES IN USING MICROCOMPUTERS (NBS SPEC. PUB. 102, MICROCOMPUTERS: A REVIEW OF FEDERAL AGENCY EXPERIENCES). IN GENERAL, WE FOUND THAT USERS WANTED MORE SUPPORT IN SELECTING AND USING MICROCOMPUTERS.

IN MANY CASES, THEIR ORGANIZATIONS ARE RESPONDING TO THAT NEED BY DEVELOPING CENTRALIZED SERVICES AND ASSISTANCE.

ONE OF THE OPTIONS FOR DELIVERING THESE NEEDED SERVICES IS THE INFORMATION RESOURCE CENTER, AN ORGANIZATION THAT COORDINATES AND CENTRALIZES SUPPORT FOR END-USERS BY PROVIDING INFORMATION, CONSULTATION, TECHNICAL ASSISTANCE, AND TRAINING AND PROMULGATES NEEDED CONTROLS FOR SECURITY AND INTEGRITY. WE HAVE DISCUSSED THE CONCEPT OF THE INFORMATION RESOURCE CENTER WITH FEDERAL AND PRIVATE SECTOR ORGANIZATIONS AT MEETINGS AND WORKSHOPS. THIS YEAR WE PLAN TO DEFINE THE RANGE OF ACTIVITIES THAT CAN BE CARRIED OUT BY INFORMATION RESOURCE CENTERS AND TO PROVIDE ADVICE ON HOW TO CARRY THEM OUT.

WE ALSO EXPECT TO ISSUE A GUIDE TO EVALUATING AND SELECTING SOFTWARE PACKAGES AND TO EXPAND OUR COVERAGE OF MICROCOMPUTERS IN THE UPDATED VERSION OF OUR TECHNOLOGY FORECAST. WE WILL CONTINUE TO OPERATE OUR ELECTRONIC BULLETIN BOARD WHICH USERS CAN DIAL UP FROM THEIR TERMINALS TO ASK QUESTIONS AND EXCHANGE INFORMATION ON MICROCOMPUTERS.

SUPERCOMPUTERS ARE ANOTHER ADVANCED TECHNOLOGY THAT WE ARE MONITORING. WE ARE COOPERATING WITH ORGANIZATIONS SUCH AS THE NATIONAL RESEARCH COUNCIL, THE DEPARTMENT OF DEFENSE, AND THE INSTITUTE FOR ELECTRICAL AND ELECTRONICS ENGINEERS TO STUDY THE TECHNOLOGY AND COLLECT INFORMATION ABOUT NEW DEVELOPMENTS. THIS IS AN AREA WHERE WE MUST MEET THE CHALLENGE OF OTHER COUNTRIES, PARTICULARLY JAPAN, BY

DEVELOPING NEW COMPONENTS AND ARCHITECTURES TO SERVE OUR FUTURE COMPUTING NEEDS.

TO HELP TRANSFER INFORMATION ABOUT FOREIGN TECHNOLOGY ADVANCES QUICKLY, WE ARE JOINTLY FUNDING A PROJECT WITH THE MICROELECTRONICS AND COMPUTER TECHNOLOGY CORPORATION (MCC). CARRIED OUT BY A PANEL SELECTED BY THE COMPUTER SCIENCE AND TECHNOLOGY BOARD OF THE NATIONAL ACADEMY OF SCIENCES, THIS PROJECT IS GATHERING INFORMATION ABOUT MAJOR COMPUTER DEVELOPMENTS IN FOREIGN UNIVERSITIES AND INDUSTRIAL LABORATORIES, GETTING IT TRANSLATED IF NECESSARY, AND DISSEMINATING IT TO U.S. RESEARCHERS AND INDUSTRY.

I WOULD LIKE TO TURN NOW TO THE THIRD AREA---SUPPORT FOR VOLUNTARY INDUSTRY STANDARDS DEVELOPMENT. WE CONTINUE TO LEAD AND ACTIVELY PARTICIPATE IN, THE WORK OF MORE THAN 60 INDUSTRY STANDARDS WRITING COMMITTEES. THE SPECIFICATIONS THAT WE DEVELOP ARE OFTEN ADOPTED BY THESE COMMITTEES AS THE BASIS FOR NATIONAL AND INTERNATIONAL STANDARDS. THERE HAVE BEEN MANY EXAMPLES OF THIS--THE DATA ENCRYPTION STANDARD WHICH I MENTIONED EARLIER, NETWORK PROTOCOL STANDARDS, AND DATA DICTIONARY SPECIFICATIONS, AMONG OTHERS. THE LATTER WERE DEVELOPED AFTER MANY MEETINGS WITH FEDERAL USERS AND VENDORS TO IDENTIFY REQUIREMENTS FOR DATA DICTIONARY SOFTWARE (SYSTEMS THAT HELP ORGANIZATIONS MANAGE AND ORGANIZE THEIR DATA FOR EFFICIENT STORAGE AND RETRIEVAL). AN AMERICAN NATIONAL STANDARDS INSTITUTE COMMITTEE RECENTLY ADOPTED OUR SPECIFICATIONS AS THEIR BASE DOCUMENT FOR AN INDUSTRY-WIDE STANDARD.

For many years we have been the only source of Standard Reference Materials (SRM) for computer storage media. The SRMs that we produce for computer tapes, disks, and cartridges are used by industry and users for quality control and performance measurement of media and associated equipment. At the request of both ANSI and International Organization for Standardization (ISO) we recently agreed to develop a reference material for 0.250 inch cartridges that are in widespread use. We are also participating in the development of standards for flexible disks.

We were successful during the past year in gaining agreement among vendors of office automation systems to implement a standard document interchange format. Use of this standard format will benefit users who will be able to move a document from one manufacturer's system to another manufacturer's system without re-keying the entire document.

The fourth area is our applied research and development, particularly of test methods and performance measures. As Dr. Ambler has noted, we have increased and intensified our laboratory based activities during the past year. We have established about ten small laboratories which ICST staff use to investigate new applications of technology, and to develop specifications, test methods, and performance measures, often in cooperation with industry and other organizations.

Our efforts to lead the development of international network standards have been successful because of the technical support that we have derived from our network laboratory activities. The network demonstration that we are preparing for this summer's National Computer Conference is one example of how our applied research leads to the implementation of standards and to the development of new products by industry. More than 20 companies will be participating in two demonstrations that will implement for the first time a draft international standard for transport protocol over local area networks. The demonstration will show that different systems can work together through networks, using emerging standards. We are helping the manufacturers test their implementations in our laboratory using measurement methods that we developed. The testing of network protocols will receive special emphasis this year as we start a new project with COMSAT to test the interconnection of local area and wide area networks using satellite communications.

One other testing effort that I want to mention is our work with the Canadian Department of Communications and ANSI to develop test frames for videotex and teletext applications. The test frames will enable manufacturers and users of videotex and teletext equipment to test terminals for correct performance of implementations of the North American Presentation Level Protocol Syntax (NAPLPS) standard.

THE LAST SUBJECT IS THAT OF INTERNATIONAL NETWORKING ACTIVITIES. I HAVE ALREADY TOUCHED ON OUR PARTICIPATION IN VOLUNTARY STANDARDS DEVELOPMENT GROUPS AND OUR LABORATORY WORK WHICH PROVIDES TECHNICAL SUPPORT. WE HAVE BEEN STRONGLY SUPPORTED BY U.S. INDUSTRY WHICH NEEDS A SINGLE SET OF INTERNATIONAL STANDARD PROTOCOLS TO ENABLE THEM TO COMPETE IN WORLD MARKETS. WE RECENTLY PROPOSED AS FEDERAL INFORMATION PROCESSING STANDARDS THE TRANSPORT PROTOCOL AND A LOCAL AREA NETWORK STANDARD THAT IS BASED ON IEEE SPECIFICATIONS. IN BOTH CASES, WE RECEIVED VERY SUPPORTIVE LETTERS OF COMMENT FROM THE MAJOR VENDORS OF COMPUTING EQUIPMENT. U.S. INDUSTRY IS ALSO SUPPORTING A COMMON SET OF PROTOCOLS FOR THE DEPARTMENT OF DEFENSE, AS WELL AS FOR THE CIVILIAN SIDE OF THE GOVERNMENT. A COMMITTEE OF OUTSIDE EXPERTS APPOINTED BY THE NATIONAL RESEARCH COUNCIL IS INVESTIGATING THE DIFFERENCES THAT EXIST BETWEEN DOD'S PROTOCOLS AND THE DRAFT INTERNATIONAL STANDARDS. THE COMMITTEE WILL REPORT LATER THIS YEAR. ALL INDICATIONS ARE THAT THE COMMITTEE IS SYMPATHETIC TO THE NEED FOR UNIFORM STANDARDS FOR THE INDUSTRY.

WE HAVE BEEN WORKING WITH INDUSTRY IN ADDRESSING THE ISSUE OF HOW MANUFACTURERS WILL CERTIFY TO BUYERS, DOMESTIC AND FOREIGN, THAT THEIR PRODUCTS WORK PROPERLY IN NETWORKING ENVIRONMENTS. WE ATTENDED AN INTERNATIONAL WORKSHOP ON THE SUBJECT LAST JUNE AND EXPECT TO PARTICIPATE IN ANOTHER INTERNATIONAL WORKSHOP THIS SPRING.

THE PROPOSED BUDGET FOR FY1985 FOR ICST'S ACTIVITIES IS $5 MILLION. AT THIS LEVEL OF FUNDING, WE WILL BE ABLE TO CARRY OUT A PORTION OF OUR ACTIVITY CONCERNED WITH THE NETWORKING OF COMPUTERS IN BOTH THE DOMESTIC AND INTERNATIONAL ARENAS. IN OTHER ADP STANDARDS DEVELOPMENT AND INFORMATION RESOURCE MANAGEMENT ACTIVITIES, WE WILL BE RELYING MUCH MORE HEAVILY ON THE COMPUTER INDUSTRY AND THE VARIOUS VOLUNTARY BODIES THAT I CITED EARLIER. ALL OTHER STANDARDS DEVELOPMENT, INFORMATION RESOURCE MANAGEMENT AND COMPUTER SECURITY ACTIVITIES WILL BE ENDED.

THANK YOU FOR YOUR INTEREST, AND I INVITE YOUR QUESTIONS.

JAMES H. BURROWS

Biography

James H. Burrows is Director of the Institute for Computer Sciences and Technology, at the National Bureau of Standards. He directs a government-wide program to develop automatic data processing (ADP) standards, provide technical advice and assistance, and carry out research in computer and information technologies. He has held this position since May 1979.

From July 1972 until May 1979, he was the Associate Director of Computer Resources for the U.S. Air Force headquarters. Prior to 1972 he directed the development of large information systems and data management projects for the MITRE Corporation and the MIT Lincoln Laboratory.

Mr. Burrows was a member of the President's Reorganization Project for Federal Data Processing in 1978, and in 1981-82 was the Chairman of the Interagency Committee for ADP, an organization of ADP policy officials representing agencies and departments. He has served on technical review panels sponsored by the National Academy of Sciences and the Office of Technology Assessment. He is currently vice-chair of the Information Systems Standards Board of the American National Standards Institute and is a member of a National Research Council panel to study computer procurement, utilization, and replacement policies of the government.

Mr. Burrows received his M.S. degree in 1952 from the University of Chicago and his B.S. degree in 1949 from the Massachusetts Institute of Technology. He is a member of the IEEE Computer Society, the Association for Computing Machinery, the American Association for the Advancement of Science and the Data Processing Management Association.

Mr. **Walgren.** Thank you very much, Director Burrows.

And we'll conclude, then, with Dr. Reneker's presentation for the Center for Materials Science.

STATEMENT OF DR. DARRELL H. RENEKER, ACTING DIRECTOR, CENTER FOR MATERIALS SCIENCE, NATIONAL BUREAU OF STANDARDS

Dr. **Reneker.** Thank you, Mr. Chairman.

I'll summarize the written testimony which I've submitted.

The Center for Materials Science provides measurements, standards, data, and scientific information on materials, including metals, polymers, ceramics, and composites which are basic to our manufacturing economy.

The productivity and competitiveness of both the advanced and basic materials sectors are served by our results.

We have a large number of specific projects with industry, and I have on the chart down there the names of companies with which we've had substantial engagements during the past 2 years.

The chart on the right is particularly interesting. It shows larger-scale interactions, and I'll talk about three areas there.

At the top the first three items deal with phase diagrams. Phase diagrams are a graphic way of summarizing important information about the structure and thermodynamics of materials.

It's very important and very timely just now to collect and evaluate that data, get it into computers, and get it into a form in which it can be rapidly disseminated.

The American Society for Metals has raised $4 million from their own constituency in a cooperative effort and are working with us in this project. The American Ceramics Society is engaged in a similar fund-raising campaign with a similar goal of $4 million. The Society of Plastics Engineers, for which this is a newer issue, are planning a workshop this fall at which they will examine the needs and the opportunities.

Mr. **Walgren.** Can you make any estimate of what our Federal contribution is in each of those areas? When they're raising $4 million, what are we doing?

Dr. **Reneker.** At the moment what we're doing at the Bureau of Standards is somewhat larger than that, perhaps by a factor of two.

Mr. **Walgren.** About $8 million in both metal and ceramics?

Dr. **Reneker.** No. Let's see. It would probably be better if I thought about that and gave you a more thoughtful answer.

Mr. **Walgren.** OK.

Dr. **Reneker.** I just haven't reflected on that particular question.

Mr. **Walgren.** We'd appreciate it.

[Material to be supplied follows:]

The National Bureau of Standards/industry cooperative program on phase diagrams includes NBS support in fiscal year 1984 in the amount of $820,000 for alloy phase diagrams and $420,000 for ceramic phase diagrams. The American Society for Metals support is budgeted over five years, and the American Ceramic Soviety is projecting support at the rate of $480,000 per year.

Dr. **Reneker.** We do have a substantial effort. Our role in this process is to insure the quality of the data, to provide the thermodynamic insights and the theoretical insights into what's going on in the systems and to monitor the collection and evaluation process. The societies, by and large, are concerned with the dissemination, the establishment of the databases, the means for integrating those databases, including phase diagram data, bibliographic data, and other factual data into a form that would be useful for each of their own constituencies. By and large, that's where they're putting their cooperative effort and putting their money.

There are a large number of people around the world who are engaged in collecting and evaluating the information and making it available to this system.

The next topic I'd like to turn to deals with the American Iron and Steel Institute, which a year or so ago recognized that in order to improve the productivity and competitiveness of the steel industry in this country we have to have better process control. They went through a thoughtful process of prioritizing the needs for sensors in that industry. One of the needs that they identified is sensors for measuring the temperature of hot steel.

We had a conference, a workshop, at the National Bureau of Standards to which industry people came, and they brought some movies of what it's like in a steel mill where these measurements have to be made. I have just a little, short clip of that on some magnetic tape that we'll look at.

[Whereupon, a videotape is shown while Dr. Reneker narrates as follows:]

These are big pieces of steel moving rapidly through the steelmaking process. One needs to know the temperature not only at the surface, which you can judge by looking at it or by optical means, but also the temperature throughout the body of that piece of steel.

This gentleman is looking into a furnace. Their narration says he looks for an ivory white color. This is a point at which we would like to put sensors on that piece of steel and measure its temperature. The technology for that has not existed. We're using or developing that technology using sound waves that we propagate through the hot pieces of steel to measure the temperature, since the sound velocity depends on the temperature. It's an elaborate process, and we're demonstrating how that can be done.

The American Iron and Steel Institute is supporting research associates in our laboratory to work with us on that project. They will take our results, make more rugged instruments that can be put into the very rugged environment that you saw in the little bit of movie.

We just a week or so ago had 40 executives from the steel companies together with 15 staff members from the Congressional Steel Caucus visit our laboratories at the Bureau of Standards, and we told them in some detail about this work.

Another area that I would like to mention deals with the Welding Research Council and the American Welding Technology Applications Center. Welding is a key process in the manufacture of big structures—pipelines, bridges, other large items. The welding community in this country recognized that things are not as they should be. We find abroad much larger coordinated efforts on welding.

The National Bureau of Standards chaired an interagency task group which met in Philadelphia this spring. Out of their deliberations came the recognition of a need for better means of transferring welding technology from the universities, from the science, into the area where the welding is actually being done.

They proposed, and in fact have established, an American Welding Technology Applications Center, and that was announced in a press conference, Mr. Walgren, which you hosted here last fall.

As they're establishing their facility, they're using our laboratory space in Boulder and working with our people in Boulder, whom you saw during your recent visit out there.

The work that's beginning is on welding thick pieces of steel and the technology that's needed to do that. The physics and the science of welding is very complicated. We want to get that under control, so that the whole process will result in perfect welds every time.

The last item that I'd like to deal with is a new facility, a new user-oriented facility, that we're planning at the National Bureau of Standards. The picture indicating posters on stand is of a nuclear reactor, and the dark blue item is a cold source. It's a block of heavy deuterated ice that we insert into the reactor. The neutrons that are in the core of the reactor are cooled to a very low temperature and to a wave length which is very advantageous for measurement.

We have in the budget a proposal for $1.5 million to install a cold source and to make two instruments. This facility that we're planning in the fiscal year 1985 budget will also provide valuable information that would let us expand this operation using guide tubes, the tubes that are in yellow [indicating graph on stand]. This is new technology which was not available when we designed the reactor. It provides a means of bringing beams of neutrons out and serving a large number of instruments.

If you can just see down in the lower left-hand corner, on a reduced scale we show that there would be at least 15 new instruments that would be available, and it would result in a world class neutron research facility. It would place the United States in a strong competitive position with our colleagues in Europe and Japan.

These are the items I wanted to tell you about. I'd be glad to answer any questions.

Thank you very much.

[The prepared statement of Dr. Reneker follows:]

U.S. Department of Commerce
Statement of Darrell H. Reneker
Acting Director, Center for Materials Science
National Bureau of Standards

before the

Subcommittee on Science, Research and Technology
of the
Committee on Science and Technology
U.S. House of Representatives

February 2, 1984

Mr. Chairmen, Members of the Subcommittee:

I thank you for this opportunity to describe the materials research program at the National Bureau of Standards.

INTRODUCTION

New materials and new materials processes are key elements in the success of our manufacturing economy. They are the basis of many advanced technologies such as high temperature ceramics, advanced alloys and polymer blends. New materials and materials processes are equally critical in enhancing productivity and product quality in basic industries, such as steel manufacture and welding.

The Center for Materials Science produces data on materials properties, measurement science, test methods, standard materials and new scientific concepts which are fundamental to the development of high performance materials and to advances in materials processing. Our programs, responsive to the NBS mission, are planned with active participation of the private sector. Agreements with industrial organizations are an important component of our programs and are listed in Attachment 1. Industry shares the cost of these major collaborative programs by providing Research Associates, specialized equipment or integrated dissemination methods. Attachment 2 shows companies with which we have had joint activities over the past two years. Not included in this list are a large number of universities with which we collaborate.

BUDGET RESOURCES

The resources for CMS are included in the Measurement Research and Standards subactivity of the NBS budget for the fiscal year 1984. These amounts are included in the line items for Materials Characterization, Processing Performance, and Applied Measurements Programs. These line items are funded at $16,961,000 in the fiscal year 1984 with 267 positions. The fiscal year 1985 level for these activities will be $19,978,000 and 292 positions. The Core Measurement Research for New Technologies subactivity includes $700,000 and 15 positions for the Center in fiscal year 1984 and $700,000 and 15 positions for the Center in fiscal year 1985 in the Metals Processing line item.

PHASE DIAGRAMS FOR ALLOYS, CERAMICS, POLYMER BLENDS

The processing of sophisticated alloys, tough polymer blends and durable high temperature ceramics depends on basic knowledge of the microstructure of materials at various temperatures as the chemical composition of the materials is modified. Such information is required first in the commercial development of new materials and then to control their production and to assure product quality. An important portion of the microstructural information is summarized graphically in phase diagrams.

Phase diagrams are essential to the development of innovative materials that can be the basis for entirely new technologies and the improvements that are essential to the continued competitiveness of our basic industries. An increasing number of evaluated and efficiently disseminated phase diagrams for materials are required.

The American Society for Metals (ASM) raised $4M to join with the Center to expand the evaluation of phase diagrams and their dissemination in on-line computer form. NBS is responsible for the technical quality of this information. ASM has sent two of its members to serve at the Bureau to assist in the computerization process and the dissemination effort. The American Ceramic Society is engaged in a similar complementary effort, and we have started down the same path for polymer blends with the Society for Plastics Engineers. The result will be the on-line availability of reliable, current, evaluated data in research laboratories throughout the country for industrially important materials of all classes.

PROCESS CONTROL SENSORS FOR THE STEEL INDUSTRY

Another major cooperative effort will provide the steel industry with the science base for sophisticated on-line measurement techniques in process control. The American Iron and Steel Institute (AISI) recognized that process control sensor development is required to improve productivity in steel manufacture and to achieve important gains in product quality as well. A task group representing 13 companies studied 35 steel processes and 537 sensors and identified four sensor needs as having highest priority in terms of their potential for productivity gains. A workshop at NBS brought together industrial, university and government specialists in steel making and sensor technologies, and specific research and development needs were identified. Subsequently, a cooperative program was initiated between NBS and AISI to develop broadly applicable measurement methods for rapid, on-line determination of internal temperature distribution and detection of porosity in steel. Both of these sensor systems couple advanced techniques for generating and detecting ultrasonics with computer assisted tomographic analysis. To transfer this advanced technology, the steel industry has sent research associates to NBS from member AISI companies to participate in the research program. Forty steel company executives, a group of AISI managers, and 15 staff members of the Congressional Steel Caucus reviewed progress in the joint program at a visit to NBS last month. The aluminum industry has also expressed interest in the temperature measurement systems being developed in this project.

AMERICAN WELDING TECHNOLOGY APPLICATION CENTER

Welding and joining are key processes in a wide variety of manufacturing technologies including fabrication of heavy steel structures, energy generation systems, pipelines, bridges, and aerospace vehicles. Opportunities exist for developing and applying advanced processing and materials technologies in welding and thereby making large improvements both in performance and in manufacturing productivity.

Many other industrial nations support coordinated welding research and development institutions to exploit these opportunities. The United States welding community recognized in a workshop convened by the Department of Defense that our position in welding needed to be strengthened in the face of continuing advances overseas, and that a coordinated strategy was required. Industrial and academic leaders in welding, working closely with a government task force chaired by the former Director of the Center for Materials Science, recommended the establishment of a welding application center. A joint government-industry task force completed plans to implement this recommendation and the American Welding Technology Application Center (AWTAC) was incorporated on October 1 last year. This was announced at a press briefing held here by Congressman Walgren.

The initial AWTAC project, dealing with the development and application of high productivity thick section welding, will utilize research associates from AWTAC working at the Center for Materials Science laboratory in Boulder while a permanent AWTAC facility is established. The Center's research on narrow gap automated arc welding will include studies of transducers for measuring and locating welding flaws, measurement techniques relating processing variables to weld toughness, and use of advanced testing techniques to relate arc behavior to flaw formation. This will lead to processing models for automated measurement and feedback control to prevent flaw formation. Also in collaboration with the American Welding Society, NBS will establish a data bank of welding properties and process information. This on-line data base will be the core of an AWTAC national information center. These collaborative activities with AISI and AWTAC support new technological approaches for increasing the productivity of our basic industries.

COLD NEUTRON MEASUREMENTS FOR ADVANCED MATERIALS

Many industrial laboratories now collaborate with our scientific staff in neutron scattering research at NBS. Allied Corporation has collaborated with us on the development of nondestructive testing techniques for on-line control of rapidly solidified metallic glasses. Bell Laboratories has used neutron scattering in joint research on electronic ceramics for small batteries. In order to optimize the properties and performance of advanced magnetic alloys, polymer blends, high performance ceramics, polymer matrix composites, and electronic materials that are opening up whole new technologies, American industry needs far better information on the microstructure of these substances and the ways in which processing affect service properties.

Cold neutrons, with their longer wavelengths, provide a powerful tool to obtain microstructural information. Cold neutrons are most readily obtained from cold sources inserted into research reactors.

We are now moving to incorporate the large cold neutron source for which our reactor was designed. We thus have the basis for the establishment of a major national facility of great importance. We are requesting $1,500,000 and six positions to provide the basic knowledge and design criteria needed to develop a world class cold neutron research facility. Our plans call for the establishment of a national user oriented facility with the installation of a high resolution time of flight spectrometer and a prototype depth profiling facility. These experiments will be designed, supported, and carried out by industrial groups in collaboration with our own staff.

The proposed cold neutron facility will place the U.S. in a strongly competitive position with respect to the existing capability in Europe and that being planned by the Japanese. Moreover, this would be achieved at a fraction of the cost of other alternatives because of the special design of the NBS reactor

FUTURE DIRECTIONS

Plans for the future directions of the Center for Materials Science are determined by consideration of industry needs and with the active consultation of academic and industry leaders. At present, we are engaged in an assessment of the technological and economic status of advanced ceramic materials; this will guide our program direction in supporting new applications for ceramics in engines, electronics, optical communication systems, and machine tools. We initiated and are now participating in a recently launched study by the National Materials Advisory Board on opportunities for nondestructive evaluation in materials processing and manufacturing. The results will help us identify a Center role in support of improved industrial quality control. The Center will host a workshop on polymer blends this year where industry and university representatives will define scientific and technological needs for polymer phase diagrams. This meeting will guide the development of our cooperative program in this area with The Society for Plastics Engineers. Finally, the Center is also represented on the National Academy of Science's Major Materials Facilities Committee which is assisting the President's Science Advisor in establishing priorities for major facilities in materials science.

I appreciate this opportunity to appear before this Committee and to summarize some of the highlights of our collaboration with American industry in materials research.

Attachment 1

Center For Materials Science Cooperation With Industry

- American Society for Metals
  - Alloy Phase Diagrams
- American Ceramic Society
  - Ceramic Phase Diagrams
- Society for Plastics Engineers
  - Blends Phase Diagrams
- American Iron and Steel Institute
  - Process Control Sensors
- National Association of Corrosion Engineers
  - Corrosion Data
- American Welding Technology Application Center
  - Welding Technology
- Welding Research Council
  - Welding Data
- International Centre for Diffraction Data
  - Powder Diffraction Data
- American Dental Association
  - Dental Restorative Materials
- Industrial Research Associates
  - Currently over 54
- Projects Utilizing Nuclear Reactor, NMR, Metals Processing
  - Laboratory, and Other Special Facilities

Attachment 2

CENTER FOR MATERIALS SCIENCE

COOPERATION WITH INDUSTRIAL ORGANIZATIONS

TRW
General Dynamics
Pratt & Whitney
McDonnell-Douglas
Hughes Aircraft
Firestone
ARDE
Malvern Scale
CNG Cylinder
Gulf
Sun Oil
Dow Chemical
Sohio
Amoco
Cominco
Pennwalt
ARCO
Westinghouse
Texaco
Union Oil
Shell Oil
Synthane-Taylor
Teledyne Testing
Northwest Pipeline

Carpenter Technology
ALCOA
ARMCO Steel
U.S. Steel
Climax Molybdenum
Kennametal
Mack Truck
Cabot
Spaulding
Alta Technology
Imass
Owens Corning
Arcadia Technar
Ciba Geigy
Dentsply
Howmedica
Hercules/Hexcel
Alpha Industries
Princeton Applied Research
Lubrizol
Imperial Oil
Airco
Micromotion
Applied Materials

Ford
Lockheed
General Electric
Exxon
Union Carbide
Allied
Dupont
Mobil
W. R. Grace
Chevron
Medtronics
Intel
Motorola
Eastman Kodak
Rockwell
Genex
IBM
Bell Labs

DARRELL H. RENEKER

Darrell Reneker became Acting Director of the Center for Materials Science of the National Bureau of Standards on November 11, 1983, having been Deputy Director since 1980. He joined the Polymers Division of NBS in 1969 and was Deputy Chief when he moved to the Center in 1980. Prior to that he had worked 10 years as a research scientist for E. I. DuPont de Nemours, Inc. in the area of polymer physics. Dr. Reneker received his Bachelors degree in Electrical Engineering from Iowa State University in 1951 and worked two years as a Member of the technical staff of Bell Telephone Laboratories. He then earned his Masters and Ph.D. degrees in Solid State Physics from the University of Chicago, using ultrasonics to investigate the electronic bond structure of bismuth. He is well known in the polymer science community for his work on crystallographic defects in polymers and other aspects of polymer physics. He is author of over 25 archival publications and was given the Silver Medal Award of the Department of Commerce in 1978.

January 1984

Mr. WALGREN. Thank you very much, Dr. Reneker.

That concludes the group of witnesses from the Bureau. We appreciate your testimony, and we'll look forward to working with you as we create a record.

Let me ask, Dr. Ambler, if you could talk with us a little bit about the overall decision to make reductions in the fire research and building research programs and that of the computer standards. We looked at these questions 1 year ago. Certainly, there is much good that happens in each of those areas. How have these programs fared over the last year, and can you tell us anything about the decision to again reduce in those areas?

Dr. AMBLER. Yes, sir. As far as I know they fared over the last year, you're familiar, of course, with the level of funding that they've had. The work in all of those areas has continued. I believe at the hearings last year I made it clear that there was no question in my own mind about the quality of the work being done in any of these organizations.

I did in my statement refer particularly to ICST. I think that the relationship between ICST and the rest of the Bureau, and indeed my own enthusiasm for ICST and the work, has changed quite a bit. It's been changing over the last 2 years, but over the last year particularly it has changed. I really feel that ICST is part of the Bureau of Standards. I suppose that implies I had some question about it in the past, and I don't think it was so much that. It was clearly by law part of the Bureau of Standards, but I had wished that the execution were a little bit more the way I felt Bureau of Standards execution should be, and I think it is. I think the laboratories that Mr. Burrows has cited in his testimony—just warm the cockles of my heart. I see that they really have the hands-on expertise.

I think in the case of ICST they've come on really strong.

As far as the rationale in the case of fire and building, it has already been stated that it's a question of point of view, that the responsibility for our safety, for building codes and building performance resides with State and local governments. Therefore, if there's to be research done in those areas, it is to be the State and local governments that pay for it.

Mr. WALGREN. Let me ask you, Dr. Ambler—in your testimony you indicate that the ICST has been particularly effective in gaining the support of users and manufacturers in the development of computer network standards and in working with the International Organization for Standardization and the American National Standards Institute to develop technical specifications for standards.

You also go on to say that particularly strong in this area—or recommended in this area is—the increase in laboratory facilities that the Institute has established to support these testing programs.

My question is, as I understand the reduction that's proposed in this area, emphasis is to be shifted and maintained in certain areas and then diverted from other areas. What I'd like to know is, how does the direction that you're going in compare with these strengths that you've cited in your testimony?

Dr. **Ambler**. Yes, the rationale for the reduction in ICST, of course, doesn't have to do with the State and local governments; it has to do with the feeling that much of the work benefits the private sector. It's a particularly strong industry, and that, therefore, they should contribute more to the support.

I think what I would like to see is the funding provided by the private sector, and the work in all of the areas continued but with a different source of funds.

The particular aspect of the work that is, in my view, most appropriate to be done on appropriated funds is that work which has to do with the international activity because that has to do with the overall position of the computer industry in the world market. It has to do with balance of payments, and has to do more with the general good than the other part of the program.

Mr. **Walgren**. Are there any specific assessments made about what might be picked up by the private sector? I know we can sort of wish and say that, "Well, gee, we think they will," but have concrete assessments, based on direct evidence, been made that the areas that you're turning away from are going to be continued?

Dr. **Ambler**. I don't think there's anything as concrete as you ask. It is an area in which all of us at the Bureau of Standards are constantly striving for; that is, more cost sharing, more involvement. This is not only because of the financial aspects, but also the more involvement you have with people on the outside by the contribution of their time and money, the more confidence you have that what you're doing is really useful. The technology transfer is taking place through people, which is, after all, the best way to accomplish technology transfer.

Mr. **Walgren**. Let me ask, then, also if you would give us some impression of where we are with respect to the under- or over-utilization of our facilities at the Bureau of Standards. Do we have facilities that are unused for substantial time periods? How effective are we in securing the fullest use of the facilities that are under the Bureau?

Dr. **Ambler**. No, I don't think there's any glaring instance of underutilization. The facilities are utilized not only by our own people, but people from the outside. You've had a lot of examples, and we can give you a very lengthy list.

Moreover, it's a thing that, because of the national interest at the present time, we're intensifying and some of the facilities, such as the reactor, are working 24 hours a day.

Now it may well be that there are some facilities that, if we did our scheduling better, we would go on two shifts or a 24-hour work schedule instead of an 8 hour. I suppose the fire facilities might be in that category, and there are probably others. We could do more.

So I suspect if we decided to look at that aspect, there would be more that we could do.

Mr. **Walgren**. Do we have people waiting in line to use any of the facilities that we have? Have we requests to do any kinds of modeling or the like that we have not granted, or are backlogged?

Dr. **Ambler**. Yes, we do in a number of areas. This is particularly true at the research reactor. One of the aspects of this cold neutron source that Dr. Reneker described was the fact that it is expandable to provide a greater number of facilities, and that would be extremely useful and, I think, used.

Right now the number of people that worked at the reactor this year—these are non-NBS people—approximately 150 people, scientists from 15 industrial firms, 22 universities, and 18 other agencies. I assume that's Federal agencies. So there's a lot already, and there are more that would like to use it.

Mr. **Walgren**. Would private firms have access to almost all the Bureau laboratories on some basis if they had a research proposal that they felt our laboratories were a good place to do it? Do we have a policy that invites that or do we have a policy that says this is an in-house operation?

Dr. **Ambler**. No, we have a policy that invites that within certain limits. Those limits are that the area of investigation has to be of mutual interest and that the work that's done is made generally available. We don't, at the present time, allow proprietary work, but that is an issue and a policy that we're looking into again at the present time.

I think we would always have to have a policy that had some restrictions because I think, if we didn't, we would run into a situation where it was being used entirely by the outside, or could be used entirely by the outside, in the case of the reactor, and we wouldn't want to do that.

Mr. **Walgren**. What about the fire facility, particularly. Dr. Lyons—is there a backlog of experiments waiting to be conducted in that particular facility?

Dr. **Lyons**. It's very uneven, Mr. Chairman. The large testroom that was shown on the tape is scheduled all the time. The reason for that is that it takes a couple of weeks to build the test and a couple of minutes to burn it down, so most of the time is spent in construction.

We have not used that facility for private work, though there would be interest because there are very few facilities like that. There are one or two places where one can go now and buy such a test.

The Bureau has had that facility pretty well scheduled 8 hours a day until—well, that's still true.

However, the thrust of your question is, it seems to me, if we wanted to accelerate by going to either two or three shifts, we could triple the throughput in those facilities, and we could make them available for private tests. I think, because of the safety question, we would have to run the tests. I don't think we want people torching off those things willy-nilly in our facility, but we could, I think, make an arrangement so that we could accommodate some work of that sort.

Mr. **Walgren**. Well, this is something we'd like to talk to you about in the future.

Let me, in the interest of the other Members' time, and trying to recognize Members in the order of their appearance, but also with some form, Mr. Gregg, would you like to make an opening statement of any kind or insert one in the record? Then I would like to recognize Mr. Brown for questioning, and then down the line in order of appearance.

Mr. **Gregg**. I think that's reasonable.

I just wish to express my regret, and other Republican Members' regret, for not being here when the hearings began. We were having a Republican conference which was important that we attend as Members, to find out what we're going to be asked to do by our leadership, and we're supposed to meet with the President at 11:30. So we have terrible scheduling problems today, and I do apologize.

We have read your submissions and will attempt to be intelligent in the time that we have.

Mr. **Walgren**. Thank you, Mr. Gregg.

Mr. Brown, for questions?

Mr. **Brown**. Thank you, Mr. Chairman.

Mr. **Walgren**. Or comments.

Mr. **Brown**. Dr. Ambler, the budget figures we have indicate reductions in three areas: The computer standards, the building structural standards, and the fire research center. I think that is where the major reductions are.

Did you recommend those reductions in any case?

Dr. **Ambler**. You're referring to my submission to the Department of Commerce, sir?

Mr. **Brown**. Yes.

Dr. **Ambler**. No, sir, I did not.

Mr. **Brown**. Did the—I just want to identify where the initiative came from. Did the Department of Commerce in their submission to OMB recommend them?

Dr. **Ambler**. No, sir, not the elimination of the program.

Mr. **Brown**. Then, basically, we have left the assumption that OMB felt that these programs ought to be reduced or eliminated in order to conform to their budget projections; is that about the shape of it?

Dr. **Ambler**. Well, I don't want to try to get into too much detail of the thinking on that, but clearly the Federal deficit is a serious concern to the Administration and OMB is certainly faced with having to recommend things that the President can accept.

Mr. **Brown**. I know that you can defend these cuts very ably, Dr. Ambler, and you'll have ample time to do that, but I just wanted to make sure we knew where they were coming from.

In each of these programs there's been a strong interest in this committee over the past several years, and I rather expect that interest will continue. I don't want to belabor the individual programs. I would like to request some additional information, if I could, in some of the areas. This may be idiosyncratic, but starting with the computer program, Mr. Burrows, I began some efforts at teleconferencing about 5 or 6 years ago, using the experimental facilities of the telephone company, and I'm very much interested in your work in teleconferencing. Would you be able to provide me with any written reports or descriptions of the experiments that you've carried out, so I'd have a little better picture of that?

Mr. **Burrows**. We'd be happy to do that.

Mr. **Brown**. I'm very much interested in this teleconferencing involving State and local government. One of the things I wanted to do was to be able to set up teleconferencing situations with State and local officials in my own congressional district, and you may have solved all the problems for me here.

Mr. Burrows. I'm sure not all of them, but we solved quite a few.

Mr. Brown. You also made reference to a forecast of future information technology produced by a consortium of Federal agencies. Since I am kind of hooked on futurism myself, I'd like to see what you have produced in the way of a forecast.

Is that a regular publication or——

Mr. Burrows. Yes, it has been a regular publication for the last 3 years, and it's a bestseller to industry, also.

Mr. Brown. Well, one of the problems that I think the Bureau has is that there aren't enough people who are aware of some of the fascinating things that you do, and I'd like to help remedy that if I can. So if you could provide me with at least the latest forecast, or maybe a representative sample of your forecasts, I'd appreciate it very much.

["Future Information Processing Technology"—1983; NBS special publication 500-103.]

You know, you are dealing with a number of areas here—computer security, for example, which is very much in the headlines in many ways, and it's extremely important that we make progress in these areas rapidly and efficiently. That doesn't necessarily mean that your agency is the only one that can do it, but there's no questioning the importance of the activity that you're carrying on there.

Going on very quickly, because I don't want to usurp all the time, Dr. Johnson, you've made some references to the development or to the expansion of your program into the area of process and quality control for other high technology industries.

Dr. Johnson. Yes, sir; that's right.

Mr. Brown. That's a new program that you're proposing, 20 positions and $2.5 million?

Dr. Johnson. We are proposing expansion there, sir, to provide us with the ability to develop some new calibration services that have been directly requested by industry.

Mr. Brown. You're familiar with Deming's work in quality control——

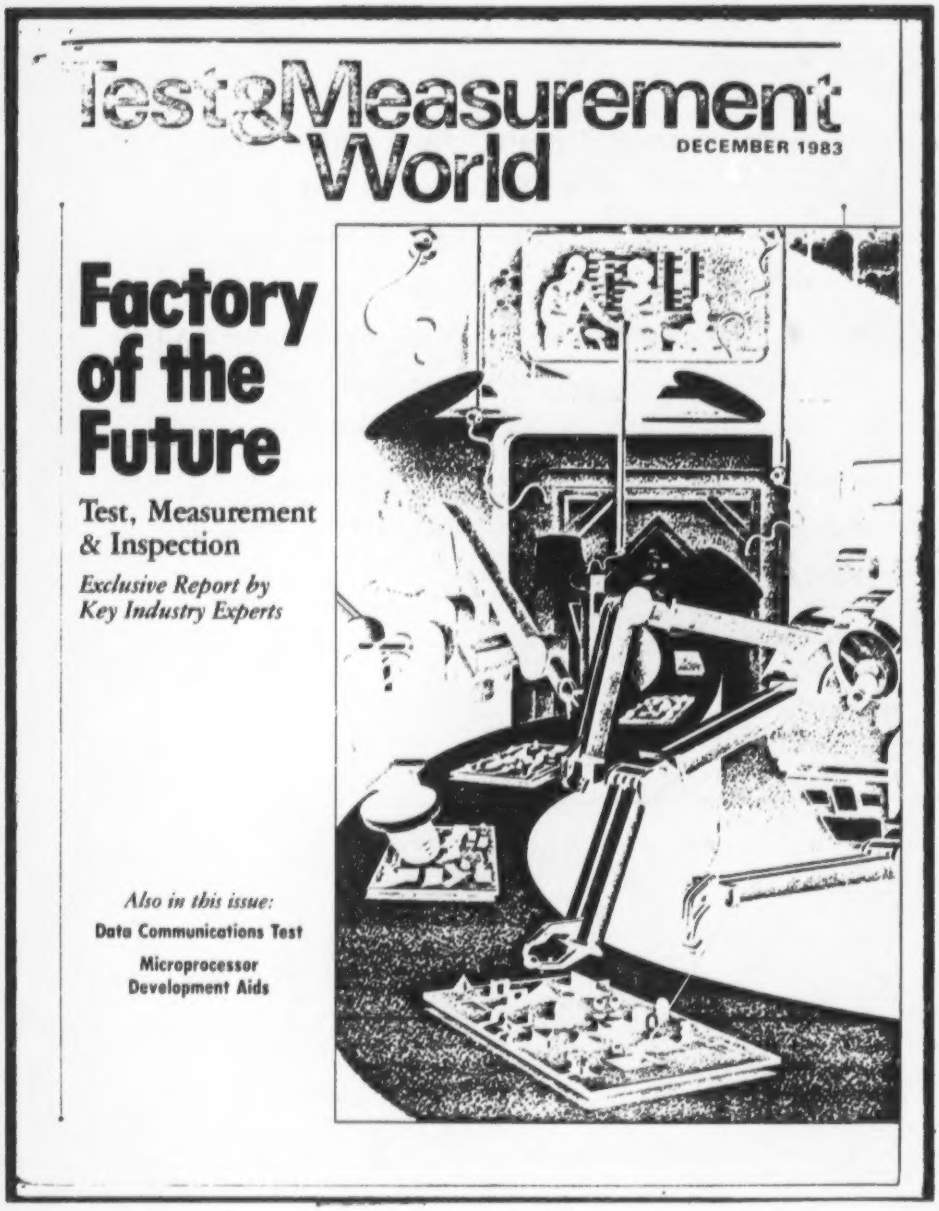
Dr. Johnson. Yes.

Mr. Brown [continuing]. And management by quality? There was an interesting article—this is not a question—a couple of weeks ago in which he stressed again the significance of the Japanese revolution and the fact that they had listened to his sermons about quality control and the American industry hadn't listened, and that's the reason that the Japanese were usurping our lead in so many different fields. You're probably familiar with that?

[The material referred to follows:]

Dr. Lyons furnished the following additional comments as a response to Mr. Brown's question.

> The National Bureau of Standards is very familiar with Mr. Deming's theory and has been concerned with approaches to improving manufacturing quality. Evidence of this can be seen in the work associated with the Automated Manufacturing Research Facility and the automation program. The approach being utilized in this program has been described by Dr. John Simpson in an article "National Bureau of Standards Approach to Quality" which appeared in the December 1983 issue of Test and Measurement World. I would like to submit that article for the record.



Test&Measurement World

DECEMBER 1983

Factory of the Future

Test, Measurement & Inspection

Exclusive Report by Key Industry Experts

Also in this issue:

Data Communications Test

Microprocessor Development Aids

National Bureau of Standards Approach to Quality

Along with its work in developing and maintaining standards, NBS studies approaches to improving manufacturing quality. In this article, originally prepared for the American Society for Quality Control, the author takes a look at an approach to process control a step beyond the current norm.

BY DR. JOHN SIMPSON
National Bureau of Standards

Director of the Center for Manufacturing Engineering at the National Bureau of Standards (NBS), Dr. John Simpson has a background in dimensional metrology, electron optics, photo-optical instrument design and mechanics. Prior to his appointment to his current position, Simpson served as Chief of the Mechanics Division, Deputy Chief of the Optical Physics Division, and Chief of the Electron Physics Section at NBS, and was a Research Physicist at Lehigh University.

The business of National Bureau of Standards is not quality control — it is to maintain the national standards for physical quantities and to develop the technology that makes these standards accessible. Those who need the standards are, more often than not, concerned with quality. So to anticipate those needs NBS must be fully aware of the situation facing its clients. From this awareness comes the "NBS Approach to Quality," although no formal institutional policy covering this matter exists. What follows is more in the nature of the personal opinions of one who is responsible for the NBS program serving the mechanical manufacturing industries.

Although NBS is in the measurement business, we are convinced that you cannot measure quality into a product. On the other hand, you cannot build quality into a product without valid measurement. The basic problem then is two sided: "How do you assure your measurements are valid?" and "How do you integrate your measurements into the manufacturing process in the most effective and efficient way?"

We can identify two competing strategies that differ in their basic approach: one focuses on the unit produced and the other on the process producing that unit. In the first case, the measurement technique involves comparison with a "model" product that exemplifies the desirable properties of the product. This strategy consists of creating or finding a unit that 'works', reproducing the unit and comparing the output to the model. The second approach to quality involves duplicating the fixed parameters of a process, usually temperature, pressure and the like. In this case, measurements are not made on product attributes but on process variables.

Since, in the words of Churchill Eisenhardt, one of NBS's distinguished authors, "measurement is a production process whose products are numbers", these two strategies are equally applicable to the problem of assuring that your measurements are valid. Over the last couple of decades this problem of measurement assurance has attracted a great deal of NBS attention. The problem of quality is the bureau's business, and we have opted for the process control strategy.

Measurement Assurance Programs Applied to Manufacturing Systems

Any quality system must be unified by a high-level theory that is complete, although not necessarily elaborate. For measurement assurance, NBS adopted the theory developed by Rudolph Carnap, who suggested that the criteria for any measurement must be independently reproducible at another time or place. In addition, each measurement procedure must include an independent check to ensure its proper performance. Because we live in a noisy universe and repeated measurements do not always produce identical results, it is necessary to rely on redundancy and statistical functions to obtain defensible results.

The statistical quality control strategy so eloquently preached by W. Edwards Deming, which springs from the same theoretical foundations as Carnap's, extends these concepts to the production arena. Here, the emphasis is on characterizing the process by measuring the product. It is important to realize that this concept does not imply a sorting operation with good product shipped and bad product scrapped or reworked. With perhaps one third of the work force engaged in rework, it is obvious that too many programs operate in this much more primitive and inefficient mode.

One may well ask "What are the circumstances in which the Deming system is not the system of choice?" I suggest that there are two cases for which this is true. One, increasingly important in the future, is where the process under consideration is flexible automation. Flexible systems lend themselves well to short runs. Such short runs do not always leave enough time to acquire the measurements needed to satisfy statistical requirements. Furthermore, flexible systems often involve the production of very wide part mixes.

Another problem in this case involves the "seamless" aspect of automated processes, where one operation flows into the next without any break, thus preventing the insertion of a measurement operation. Therefore, one must either interrupt the process, which reduces the productivity gains of automation, or wait until the completion of a station's operation, thus risking the high degree of value added at that station. As increased performance requires the use of more exotic, high unit cost materials, the latter option becomes even less desirable.

There is a second case — even more problematic — for which it is not possible to establish a tight cause and effect relationship between a product attribute and a process variable. Such cases include truly random events such as faults in a silicon chip or specks of dust on a photomask.

In the future, NBS believes that the predominant quality control strategy will involve direct process control — not the measurement of product attributes. This "make it right the first time" philosophy will depend on a concept gaining credence at NBS called "Deterministic Metrology". This concept is based on the premise that future automated manufacturing environments will incorporate precharacterized, uniform incoming materials and a well-understood process that permits valid predictive modeling. This strategy will make it possible to monitor the process in real time and prevent the the production of a bad product.

Although the only difference between this and the Deming approach is the monitoring of the process directly by sensors on the machine, instead of measuring the attributes of the product, the implications for quality control and the metrology that supports it are profound.

Factory of the Future

With this approach, most of the measurements taken by metrologists or QC personnel will be separate from the production process and will be made during the manufacture of the process machinery or during the set up period prior to the production run. Instead of a large number of simple measurements of part attributes, there will be relatively few complicated measurements that characterize the process. Moreover, understanding the algorthims that control the process will require computer software skills beyond those currently demanded of QC personnel.

New formal procedures will have to be developed to replace those of the current "traceability chains". In addition, it will be necessary to pay increasing attention to self checking the sensors upon which the entire quality assurance depends. All in all, the benefits reaped by this new way of doing things are so large that it is only a matter of time before it is adopted widely.

On the other hand, there will always be environments unable to meet the conditions necessary for the adoption of "deterministic metrology". Examples include processes in which uncontrollable parameters affect the product, or for which the current state of knowledge does not permit the creation of a predictive model. In these cases, the only solution appears to be the further development of automatic testing to sort good product from bad at the earliest point in the production cycle.

Clearly, the research agenda for manufacturing engineering in the near future is to reduce these cases to a minimum. As direct process monitoring gains in sophistication, statistical quality control — the current strategy of choice — will fall from favor and become an exception.

Dr. JOHNSON. Yes, sir, we're very familiar. In fact, we extracted a number of ideas from Deming's work in the process of developing this budget initiative.

Mr. BROWN. Could you provide me with a little bit more detail on what you're proposing to do there, because I've been asserting—not that I wholeheartedly believe everything that Deming says, but he's right on target in many areas. If you could provide me with a little more detail on what you're proposing to do in this area of process and quality control, I think I could make use of it in helping to educate some of the other Members of the Congress in the significance of this.

There will be a lot of debate this year on industrial policy amongst the candidates for every office, including President. There's nothing more significant to industrial policy in this country than the steps that we can take to improve in the quality of our products. I don't think most people recognize the contribution the Bureau makes in this area, and I'd like to help generate that, if I can.

Dr. JOHNSON. Mr. Brown, we'd be very happy to submit some material in writing that would help you address this kind of topic.

Mr. BROWN. All right. If you would, I'd appreciate it very much.

[Material to be supplied follows:]

NBS AUTHORIZATION HEARINGS
HOUSE SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE

2 FEBRUARY 1984

Link between NBS Measurement Services and Industrial Quality Assurance

The link between NBS measurement services and industrial quality assurance is established through two important mechanisms for implementing quality control: standards and measurement technology. Standards provide the basis against which actual product attributes are compared to determine product quality. Measurement techniques and data provide the means for comparing product attributes against standards. NBS provides physical, chemical, and engineering measurement standards, techniques, and data, all of which are essential for implementing quality control.

There are two basic approaches to quality control, both of which employ measurements and standards. The first (and more traditional) approach emphasizes post-production inspection of the materials or product and comparison of it with an ideal or model. If it conforms within certain tolerances, it is accepted; if not, it is rejected. Each production unit may be tested separately. Statistical sampling may be used to select some items for testing when inspection results in destructive testing of the item or to reduce the overall cost of the quality control process.

The second approach is to monitor directly and adjust the parameters of the production process itself. This approach to quality control has been used extensively in such industries as chemical and ferrous metals, but is relatively new to most other industries. The basic concept underlying this approach is that a process cannot change from making "good" products to making "bad" products without first changing some process parameters. Hence, by monitoring the state-of-the-process and inhibiting change in that process, defective products can be avoided.

The process control approach to quality control may be achieved by periodically calibrating production machinery off-line or it may be through on-line, real-time monitoring of process parameters, with built-in feedback. The on-line, real-time process control approach is becoming increasingly utilized and may well hold one of the keys to the future of U.S. competitiveness in world markets.

Process control--particularly on-line, real-time control--is important because it provides a way largely to overcome the conflict that has often existed between quality goals and productivity goals. Quality improvements have often meant a large sacrifice in the quantity of output due to the need to scrap or rework a completed product found defective in a post-production inspection. "Making it right the first time," through improved control of the production process itself, can substantially reduce these costs.

NBS supports quality control in many different industries in a variety of ways. Listed below are a series of specific examples illustrating NBS contributions to quality control in the manufacturing of (1) iron and steel, (2) high performance ceramics, (3) semi-conductor components and devices, (4) medical instrumentation and (5) polymeric materials.

Ferrous and Nonferrous Metals

In 1905, shortly after NBS was established, the American Foundrymen's Association requested assistance with measurements used for quality control during the production of cast iron. The principal objective was to improve control over the amount of carbon and sulfur in iron to meet quality specifications. NBS responded by producing a set of 4 gray cast iron Standard Reference Materials (SRMs) of different composition. SRMs are well-characterized materials with specific physical and/or chemical properties that are accurately measured and certified by NBS.

There are now over 100 different NBS SRMs used in quality testing applications in the steel industry. For example, the set of American society for Testing and Materials (ASTM) test methods for the analysis of low alloy steels and related materials is used to analyze products covered by over 500 specifications established by ASTM, the Society for Automotive Engineers, and the American Iron and Steel Institute. In this case, a variety of NBS SRMs and certified reference materials from the United Kingdom are used to establish the accuracy, reproducibility and repeatability of the ASTM standard methods. A series of 10 low alloy steel SRMs (SRMs 361-365 and 1261-1265) are used extensively in these tests. Nearly 90% of the world's production of low-alloy steels is controlled directly or indirectly by tests using these NBS SRMs.

Another example of the use of SRMs in quality control in the metals industry is activities in the U.S. aimed at improving the analysis of trace elements in unalloyed copper. As part of the trace element benchmark SRM program, NBS has been cooperating with industrial laboratories and ASTM in an effort to produce a series of unalloyed copper SRMs certified for chemical composition and containing the useful concentration ranges for 25 to 30 important trace elements. Impurity elements and their concentration levels in refined copper have a large effect on such properties as electrical conductivity and thus on product performance in a number of energy-related applications. For example, the presence of as little as 50 µg/g of Fe in copper wire can reduce the electrical conductivity by as much as 4%. Chemical composition specifications for unalloyed copper products have become so severe that disputes among producers and consumers have resulted. To promote measurement compatibility and standardization in this multibillion dollar a year industry, NBS was asked to provide accurately characterized trace element SRMs. ASTM standard methods have been developed for analysis of unalloyed copper.

Together with existing copper ore SRMs, the new copper benchmark SRMs provide coverage of nearly all the copper materials cycle from the mining through fabrication stages. Figure 1 illustrates the different stages in the copper materials cycle. Analytical measurements are important for quality and process control at many different points in the cycle. The four copper ore SRMs issued by NBS (SRMs 330 [copper millheads], 331 [copper milltails], 332 [copper concentratel], and 333 [molybdenum concentratel]) are for use at the critical points of cycel involving ore concentration and benefication. In addition to copper composition, several trace elements are of major concern at this stage of the cycle. For example, there are the important precious metal by-products (rhenium, gold, and silver).

The unalloyed copper benchmark trace element SRMs are designed to be used with measurements made during the smelting, refining, casting, and fabrication stages of the copper materials cycle. More than 70 participants cooperated with NBS in this major project, with 16 companies providing the base materials and 22 laboratories cooperating in the analytical program for certification. The program had active participation from Canada, South America, the European Economic Community, and a major effort from both industrial and government groups in South Africa (coordinated through the South African Bureau of Standards).

In the case of the unalloyed copper benchmarks, a series of different materials were developed covering the composition range of the products from blister through electrolytic copper. Some of these materials were processed into different forms, e.g., chips or rods. This set of SRMs contain between 25 to 30 elements, generally covering the concentration range of from 0.1 to 500 ppm. Total copper covers the range from approximately 99 to 99.999+%.

As materials are developed for use in high-performance applications, the specifications for materials become more demanding on production capabilities. This, in turn, leads to a greater demand for better characterized reference methods and reference materials. For example, the typical NBS compositional SRM for use in the steel industry in the 1920's was certified for about a half dozen bulk constituents. Now, over 40 elements, many of them at the part per million level, must be certified to provide sufficient information to evaluate metallurgical properties such as ductility or corrosion resistance. In many cases, the bulk constituents should be certified at accuracies of 0.1% or less, while the trace constituents can hopefully be certified to accuracies of several percent or better.

High Performance Ceramics

The NBS Center for Materials Science (CMS) is developing test methods and evaluated reference data to support quality control in the production of high performance ceramic materials. Advanced ceramics have many important applications. They include ceramic components for automobile engines and new types of substrates for microelectronic devices. Such applications are highly desirable because of special properties of ceramics. For example, ceramic automobile engine parts may be operated at higher temperatures, resulting in improvements of 30 to 40 percent in fuel efficiency.

A major problem preventing the full use of ceramics in high performance applications is inadequate product reliability. Current products are subject to high rates of mechanical failure in use and a high degree of variability in performance properties. Components with the desired quality properties cannot be reliably and reproducibly manufactured without a better understanding of and control over manufacturing processes.

One approach to improving mechanical properties of ceramics is through "transformation toughening" that is, converting the ceramic from one phase to another phase with more desirable mechanical properties. The transformation is accomplished by varying the composition and/or process parameters such as temperature. This procedure is inherently dependent on phase equilibria relationships. NBS provides phase diagrams describing these relationships. A typical phase diagram shows when a ceramic of a given composition will melt, or vaporize or separate into components. Because such phase diagrams relate properties of the ceramic to external conditions such as temperature and pressure, they are essential to quality control, design and use of ceramics.

Semiconductor Technology

Another major example of NBS services that support quality assurance in manufacturing deals with semiconductor technology. Semiconductor devices and integrated circuits lie at the heart of the modern electronics revolution. Semiconductor technology is therefore central not only to electronics but to the economic and social health of modern industrial societies. Rapid advances are being made in the manufacture of increasingly more densely packed microelectronic devices,such as microprocessors and memory, with important consequences for measurement technology and quality control. The very-large-scale integrated circuits now coming into use may have hundreds of thousands of transistors contained on a chip only a few millimeters on a side, with feature sizes of 2 micrometers for production devices. New measurement methods are needed for characterizing materials, for process and assembly control, and for device testing.

In the NBS Center for Electronics and Electrical Engineering, particular emphasis is placed on supporting the quality control of input materials and the manufacturing process in semiconductor technology, with lesser emphasis on measurements relating to finished packaged devices at present.

For example, the single most important parameter of the starting silicon material used to produce microelectronic devices is resistivity. At the input stage of the fabrication of integrated circuits, high-purity single-crystal silicon doped with trace amounts of impurities such as boron and phosphorus are grown and then sliced into thin wafers for use as substrates on which the product circuits are subsequently formed. Many manufacturers of integrated circuits buy this starting material, rather than produce it themselves. To determine if the silicon meets the process specifications for electrical resistivity, the buyer measures this parameter relative to a standard specification, utilizing well-characterized, generally accepted test methods such as the four-point probe methods of ASTM, to which NBS has made major contributions. To support these and other resistivity measurements, NBS certifies a series of resistivity SRMs (1521-1523, 2526, 2527) [6]. These SRMs are used to calibrate instrumentation for measuring the electrical resistivity of the silicon slices at the beginning of the manufacturing process and also at appropriate subsequent stages.

For supporting the integrated circuit manufacturing process itself, NBS provides other reference standards and measurement tools. SRM 474 is an optical microscope linewidth-measuring standard for calibrating instruments used to measure the width of lines on photomasks, which can be thought of as the negatives used in a photographic-like process to produce the various layers of completed integrated circuits. Linewidth is the most critical dimensional parameter; failure to measure the linewidth on the photomask with sufficient accuracy equates to failure to control the performance of the completed device. SRM 474 provides a series of reference lines on a photomask-like artifact in the range 0.7 to 10 micrometers and certified to ±0.05 micrometer. To promote the use of this SRM and the NBS-developed measurement technology it embodies, NBS periodically offers hands-on training workshops to teach industrial technicians and engineers how to use the photomask SRMs to assure the quality of their linewidth measurements. About 400 individuals from over 100 companies have been trained in these linewidth measurement seminars, held both at the NBS laboratories in Gaithersburg and in "Silicon Valley" in California; most major U.S. semiconductor manufacturers now use SRM 474 as their linewidth measurement base.

A recent trend is for industrial and academic integrated circuit designers to contract for the actual production of the wafers by a commercial entity known as a silicon foundry--a process line for hire. NBS test chips can be incorporated into the overall circuit design configuration and then may be used by other the designer and the foundry to verify that the parameters specified for the process were in fact achieved. The test chip thus provides the buyer (the designer) and the seller (the foundry) a uniform basis for measurement for resolving questions on quality.

Medical Instrumentation

Clinical measurements represent a rapidly growing segment of the economy. A conservative estimate of the size of this market is that over $10 billion in fees are collected for over 4 billion clinical tests made each year. The medical instrumentation industry, which provides the analytical and test equipment for clinical testing, is also growing rapidly.

NBS has developed over 50 SRMs for use in determining the accuracy of clinical data and methods, as well as for evaluating commercially produced reference materials; in calibrating instruments and testing their performance; and in comparing clinical data from laboratories using different methods and instruments.

The clinical SRMs may be classified into three general types:

- human serum matrix materials with accurately certified constituents;
- high-purity organic and inorganic compounds for preparing solution calibrators or spiking matrix solutions; and
- instrument-performance SRMs.

NBS also certifies a series of special short-lived radionuclides (e.g. Iodine-125) for quality control in nuclear medicine applications.

NBS has certified three human serum SRMs. SRM 909 is certified for electrolytes and organic constituents at "normal" levels in human serum. At present, the certificate lists certified concentration values for calcium, chloride, cholesterol, glucose, lithium, magnesium, potassium, and uric acid. Urea and total protein have also been determined and their concentration values will be added to a revised certificate upon completion of the statistical evaluation. All of these constituents were determined using isotope dilution mass spectrometric procedures, considered definitive methods because of their high accuracy.

A human serum matrix (SRM 900) certified for subtherapeutic, therapeutic, and toxic concentrations of four antiepilepsy drugs--phenytoin, ethosuximide, phenobarbital, and primidone--has also been issued. This SRM was developed in response to a survey indicating inaccurate drug levels being reported by the majority of laboratories surveyed.

SRM 1599 is a human serum matrix that contains certified concentrations of two other widely used antiepilepsy drugs--valproic acid and carbamazepine. A number of clinically important organic and inorganic compounds certified for purity are also available.

In the medical instrumentation field, SRMs are used by commercial producers of "control serum" to assure the quality of their products and are also used for evaluating and ensuring the performance of medical instrumentation while in service.

Aerospace, Avionics and Defense Related Systems

One of the largest segments of U.S. industry is represented by manufacturers of aerospace, avionic and defense-related systems. The complexity of modern weapons and aerospace systems is increasing dramatically. Such sophisticated systems cannot be manufactured, tested, and deployed unless a wide variety of high accuracy measurements and calibrations can be performed to support them.

NBS has developed a wide range of instrument calibration services and Measurement Assurance Programs (MAPs) to assist the Department of Defense, defense contractors and the aerospace industry in support of newly developed systems. Much of this support involves assuring the precision and accuracy of test methods used at various stages of the quality assurance cycle. Limited space does not allow a complete description of the many NBS activities in this area. However, a brief summary of several of the major kinds of measurement technologies is given below to illustrate the diverse technical requirements imposed by these new technologies: Such requirements include:

Infrared Technology - New infrared guidance systems, forward-looking infrared systems (FLIR Technology), and thermal imaging technology for surveillance systems require calibration of thermal imaging systems that employ infrared detectors. Recent interlaboratory tests by the Air Force subcontractors indicate large interlaboratory discrepancies of the order of 250% in the measurements being made. NBS currently has facilities to calibrate infrared test bench equipment in the range of -50 to 150 °C to an accuracy of 0.05 °C. New technologies require an improvement in the accuracy to at least 0.02 °C.

Avionics - NBS provides a wide variety of electrical and electronic calibration services to DoD and its contractors to assure the accuracy of test equipment used to evaluate the performance or calibrate avionic systems. These include calibration of voltage, phase angle, ac-dc converters, microwave and millimeter wave equipment and antenna systems.

Laser Technology - Lasers are being increasingly used in defense applications. The use of lasers in range finders and target designators requires accurate measurement of the beam profile. Laser power measurements are important in evaluating the performance of other weapon systems. NBS currently provides calibration services for characterization of lasers at a variety of power levels and wavelengths.

Figure 1

Copper Materials Cycle

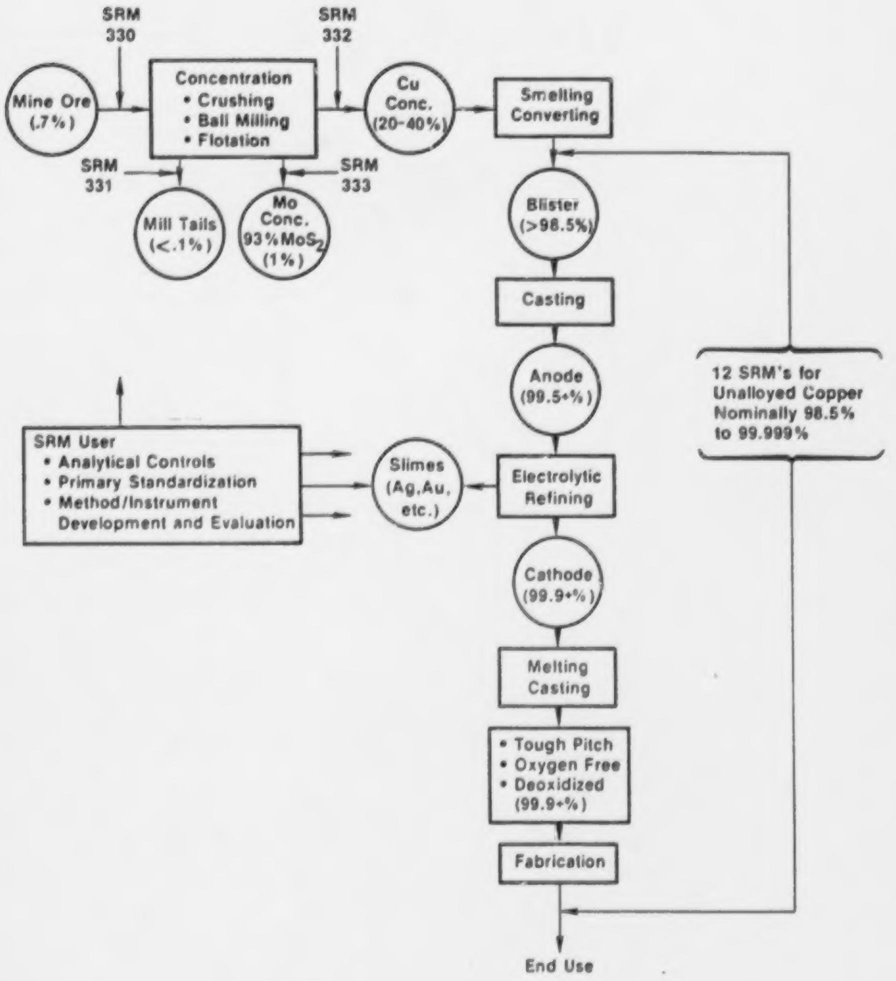

SRM 330
SRM 332
Mine Ore (.7%)
Concentration
• Crushing
• Ball Milling
• Flotation
Cu Conc. (20-40%)
Smelting Converting
SRM 331
SRM 333
Mill Tails (<.1%)
Mo Conc. 93% MoS2 (1%)
Blister (>98.5%)
Casting
Anode (99.5+%)
12 SRM's for Unalloyed Copper Nominally 98.5% to 99.999%
SRM User
• Analytical Controls
• Primary Standardization
• Method/Instrument Development and Evaluation
Slimes (Ag,Au, etc.)
Electrolytic Refining
Cathode (99.9+%)
Melting Casting
• Tough Pitch
• Oxygen Free
• Deoxidized
(99.9+%)
Fabrication
End Use

Figure 1 Illustration of the use of various NBS Copper SRMs for quality control at different points in the Copper Materials Cycle.

Mr. BROWN. You mention that an independent panel of industrial and Government experts have reviewed your priorities. Do you have a written report of some sort that confirms that statement that you made?

Dr. JOHNSON. Yes, we do.

Mr. BROWN. Could I have a copy of that, also?

Dr. JOHNSON. Yes, sir.

Mr. BROWN. Thank you.

[Material to be supplied follows:]

NBS AUTHORIZATION HEARINGS
HOUSE SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE

2 FEBRUARY 1984

DEVELOPMENT OF THE NBS FY 85 PROCESS AND QUALITY CONTROL INITIATIVE

The "quality" of goods or services can be defined as a measure of how closely a product (including a service such as a medical diagnostic test) conforms to specified standards. The term "quality control" refers to the individual activities aimed at ensuring that product attributes conform to quality specifications. "Quality assurance" is used to describe the whole system of policies, guidelines, and procedures that an organization uses to establish and maintain specific standards of product or service quality. Six key elements of a typical quality assurance system used by product manufacturers are given below. A similar set of elements apply to quality assurance systems used by organizations whose outputs are services such as calibration laboratories and medical diagnostic laboratories. These elements represent a subset of the more general requirements for a total quality assurance program (e.g. management training) as annunciated by Deming, Juran and others. The six key elements are:

1. Formulating the company's quality objectives based on its philosophy regarding quality and taking into account market demand for quality, technical capability and resources of the organization;

2. Setting product specifications, which involves translating the broad quality objectives into specific requirements to conform to product standards;

3. Controlling the quality of inputs (e.g. raw materials and/or component parts) used in production;

4. Process control, that is, controlling the production process to avoid the production of products that do not meet specifications or are defective;

5. Evaluating the quality of outputs by comparing product characteristics, production, against specifications; and

6. Influencing and otherwise ensuring quality of the product in use by carrying out product field services for consumers, such as training courses and also providing for adequate product maintenance.

In response to measurement needs identified in several measurement requirements studies, NBS developed nine major technical areas for focus:

- Electrical
- Temperature, Pressure and Vacuum
- Ionizing Radiation
- Optical Radiation
- Electronics
- Time and Frequency
- Analytical Chemistry
- Dynamic Force
- Statistical Quality Control

Several specific projects were later identified to address the most urgent needs in these nine areas. Table 1 list these projects catagorized under the nine areas.

NBS developed a priority ranking criteria which was used to establish initial project priorities and also serve as a guide for the NBS initiative planning Committee. This Committee, composed of 14 NBS managers and technical experts, developed a preliminary FY85 Process and Quality Control initiative based on formal technical reports and informal advice of industrial and academic scientists as well as input obtained from others during various workshops, seminars, and industrial laboratory visits.

NBS also obtained advice from a number of other technical organizations concerning measurement requirements and priorities. These organizations include:

1. National Conference of Standards Laboratories (NCSL), Committee on Measurement Requirements, Delbert H. Caldwell, Chairman, Navy Metrology Engineering Center, Pomona, CA. In May 1983, NCSL published the results of the 1982 National Measurement Requirements Survey. Technical requirements identified in that survey are consistent with NBS priorities in the FY85 initiative.

2. Council on Optical Radiation Measurement (CORM) Fred W. Billmeyer, Jr., Secretary, Rensselaer Polytechnic Institute, Troy, NY. CORM'sprimary objective is to establish consensus among interested parties on industrial and academic requirements for physical standards, calibration services, and inter-laboratory collaboration programs in the field of optical radiation measurements. CORM's requirements were reported to NBS in August 1982 and also factored into the NCSL Requirements Survey.

3. Conference of Radiation Control Program Directors, Task Force on Ionizing Radiation Measurements. This organization assisted NBS in preparing the special report on Requirements for an Effective National Ionizing Radiation Measurements Program, which was submitted to Congress in 1981.

NBS then formed a Special Review Panel on Calibration Support Projects. Jerry L. Hayes, Navy Metrology Engineering Center, Pomona, CA, served as panel chairman. The other panel members are listed in Table 2. This panel critically evaluated all projects proposed by NBS in the initial formulation of the FY85 initiative, except those relating to chemical metrology, frequency standards, and electronic measurements. The latter proposals were reviewed by NAS/NRC Board of Assessment Panels. In addition, the electronic measurement requirements were extensively reviewed in the NCSL Requirements Survey cited above. The Hayes panel was asked to comment on NBS priority criteria, project proposals, and the initial NBS priority list. Mr. Hayes submitted a summary of panel member priority rankings to NBS and comments were also received by NBS from individual panel members. A copy of Mr. Hayes letter to the NBS Director, a list of the projects identified and the priorities, a summary of the project objectives, and the ranking criteria used by the panel are included at the end of this narrative package.

Having received input from the Special Review Panel on Calibration Support projects, as well as other organizations and panels cited above, NBS managers then formulated a final composite set of research priorities for the FY85 process and quality control initiative. The final priority list identified thirty projects which would require some $13.5M to support measurement research and activities associated with each of those projects. The goal of the proposed NBS FY85 Process and Quality Control Initiative is to provide key measurement services to industry for use in process and quality control applications. The long term objectives of the initiative are:

1. Perform basic research needed to develop new calibration services and provide key data;
2. Develop new measurement standard, instrumentation, and methods;
3. Develop new automated measurement systems; and
4. Provide documentation and training material to accelerate measurement technology transfer.

The $2.5 million in funding requested from Congress is to support work in the first five projects on the priority list including funding for statistical supporting services.

TABLE 1
LIST OF PROJECTS

ELECTRICAL

- Impedance
- AC & DC voltage
- Documentation & Training
- Resistance

TEMPERATURE
PRESSURE & VACUUM

- Vacuum & leak rate standards
- High-pressure
- High-temperature resistance thermometer
- Primary temperature facility
- Barometric pressure
- Secondary thermometers
- Time dependent pressure

TIME & FREQUENCY

- Primary standard R&D

IONIZING RADIATION

- Measurements for Radiation therapy & protection
- Radon measurements
- Neutron dosimetry
- High-dose applications
- Beta particle dosimetry
- Radioactivity measurements

OPTICAL RADIATION

- Spectroradiometry
- Spectrophotometry
- Pulsed radiometry
- Documentation & quality control

ELECTRONICS

- Noise Measurements
- Low frequency measurements
- Millimeter wave measurements
- Transparent metrology

ANALYTICAL CHEMISTRY

- Methods for complex mixtures & high-tech materials
- Chemometrics
- Molecular compositional mapping

DYNAMIC FORCE

- Dynamic performance of force transducers

TABLE 2

SPECIAL REVIEW PANEL ON CALIBRATION SUPPORT PROJECTS

Mr. Jerry Hayes
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Naval Weapons Station
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P.O. Box 2436
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Mr. Roger H. Schneider
Director, Electronic Product Division
HFX-200
Bureau of Radiological Health
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Rockville, MD 20857
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DEPARTMENT OF THE NAVY
METROLOGY ENGINEERING CENTER
NAVAL WEAPONS STATION, SEAL BEACH, POMONA ANNEX
P. O. BOX 2436
POMONA, CALIFORNIA 91769

IN REPLY REFER TO
50/JLH:ic
Ser 0774
25 March 1982

Director
National Bureau of Standards
US Department of Commerce
Washington, DC 20234

Attn: Dr. J. Simmons

Gentlemen:

The Special Review Panel on National Measurement Laboratory Calibration Support Projects has considered the twenty-eight modules transmitted by your recent letters.

We have met in person and by telephone to provide a review and ranking of the proposed projects. Because of the short deadlines, it has not been possible to provide detailed review comments and explicit numerical priority designations. However, the Panel decided that it could furnish a general priority designation that might be as valuable. Accordingly, the projects have been grouped by A, B, and C, with A as the highest priority, C the lowest. Several Panel Members indicated a lack of knowledge or awareness of certain project modules and we agree these would be rated NR, for "Not Reviewed/Rated".

Enclosure (1) gives an individual and composite ranking. Enclosure (2) provides some comments connected with the Navy's ranking. It is understood that individual panel members will send such notes or comments as they may have evolved directly to NBS for information. Enclosure (3) is a roster of Panel Members for reference purposes.

Sincerely yours,

J. L. HAYES
Panel Chairman

Copy to:
Panel Members

Encl:
(1) Priority Matrix on NML Calibration Support Projects
(2) NML Calibration Support Projects
(3) Roster of Panel Members
(4) Additional Projects Recommended by Rockwell International

PRIORITY	PROJECT TITLE	PROJECT FUNDING LEVEL $K
1	Measurements for Radiation Therapy & Protection	228
2	Vacuum & Leak Rate Standards	354
3	Spectroradiometry	565
4	Electrical Impedance Measurements	359
5	Electronic Noise Measurements	968
6	Primary Frequency Standard R&D	2,146
7	Methods for complex mixtures & high-tech materials	1,635
8	High-pressure measurements	270
9	AC & DC voltage	406
10	Radon measurements	223
11	High-temperature thermometry	157
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SUMMARY OF PROJECT OBJECTIVES

ELECTRICAL

- o IMPEDANCE
  - -- New, automated measurement systems for the quantities of capacitance and inductance
  - -- Facility to calibrate dissipation factors of capacitors
- o AC & DC VOLTAGE
  - -- Finish automation of primary voltage standard
  - -- New solid state transfer standards
  - -- Extend range of DC voltage service
- o DOCUMENTATION AND TRAINING
  - -- Documentation of impedance metrology and quality control procedures for resistance
  - -- Training seminar materials for electrical areas
- o RESISTANCE
  - -- Automated measurement system with extended high resistance range for DC resistance
  - -- New AC resistance measurement system

TEMPERATURE, PRESSURE AND VACUUM

- o VACUUM & LEAK RATE STANDARDS
  - -- New primary vacuum and leak rate standards and calibration facilities
- o HIGH PRESSURE
  - -- New primary standards with reduced error limits for high pressure ranges
- o HIGH TEMPERATURE RESISTANCE THERMOMETER
  - -- New primary standard and measurement system for high temperature range 500-1000 °C

- o PRIMARY TEMPERATURE FACILITY
  - -- Automated calibration facility for low temperature range (below room temperature)
- o BAROMETRIC PRESSURE
  - -- Improve accuracy of barometric range standards
  - -- Improve transfer standards
- o SECONDARY THERMOMETERS
  - -- Transfer calibration technology to private sector with a Measurement Assurance Program
- o TIME DEPENDENT PRESSURE
  - -- New primary standard and calibration system

TIME & FREQUENCY

- o PRIMARY STANDARD R & D
  - -- Build new optically pumped primary frequency standard for NBS and transfer standards for field use
  - -- Research promising cooled ion technology for future standards

IONIZING RADIATION

- o MEASUREMENTS FOR RADIATION THERAPY & PROTECTION
  - -- New standards and dosimeter for Quality Assurance Program
- o RADON MEASUREMENTS
  - -- National Calibration Facility
- o NEUTRON DOSIMETRY
  - -- Improved, Automated Calibration Facility
- o HIGH-DOSE APPLICATIONS
  - -- New Calibration Facility and transfer standards

- BETA PARTICLE DOSIMETRY
  - New primary standards for absorbed dose dosimeters
  - New calibration system
- RADIOACTIVITY MEASUREMENTS
  - Automated calibration system

OPTICAL RADIATION

- SPECTRORADIOMETRY
  - Extended range and improved accuracy of measurement system
  - Develop new measurement methods
- SPECTROPHOTOMETRY
  - New measurement methods with extended range
  - New transfer standards
- PULSED RADIOMETRY
  - Improved accuracy of radiometric scale for pulsed sources
- RADIOMETRIC DOCUMENTATION AND QUALITY CONTROL
  - Improved documentation in pyrometry, spectroradiometry, photometry and spectrophotometry

ELECTRONICS

- NOISE MEASUREMENTS
  - New methods and standards for low level electronic noise measurements in higher frequency ranges
- LOW FREQUENCY MEASUREMENTS
  - Extended range of AC current to small currents for testing electronic components

- -- New standards for waveform generators and amplifiers

o MILLIMETER WAVE MEASUREMENT

- -- New methods, standards and calibration facility for high frequency range for the electronic parameters: attenuation, power, impedance, noise and phase noise

o TRANSPARENT METROLOGY

- -- New measurement methods for performance parameters of communication systems

ANALYTICAL CHEMISTRY

o METHODS FOR COMPLEX MIXTURES & HIGH-TECHNOLOGY MATERIALS

- -- New analytical methods for multicomponent systems and low concentrations

o CHEMOMETRICS

- -- New mathematical models of the total analytical measurement system to give multicomponent profile of the sample

o MOLECULAR COMPOSITIONAL MAPPING

- -- New analytical techniques for measuring concentrations of molecules as a function of their position in the sample on a size scale as small as a micrometer

DYNAMIC FORCE

o DYNAMIC PERFORMANCE OF FORCE TRANSDUCERS

- -- New calibration facility and procedures

PRIORITY RATING CRITERIA

o	EXTERNAL DRIVING FORCE	0-20
o	EXPECTED EXTERNAL IMPACT	0-20
o	LEVERAGE	0-10
o	EXPECTED INTERNAL IMPACT ON DELIVERY OF SERVICES & TECHNOLOGY	0-20
o	TECHNICAL MERIT	0-10
o	LACK OF ALTERNATIVES	0-10
o	URGENCY	0-10

Mr. Brown. Thank you, Mr. Chairman.

Mr. Walgren. Thank you, Mr. Brown.

The Chair would like to recognize Mr. Valentine at this point.

Mr. Valentine. I got here late, as you see.

We were handed these little boxes, and I was delighted that it was not ticking, Mr. Chairman.

Mr. Brown. They can make it tick over there.

Mr. Valentine. I wonder if you would tell us, Dr. Ambler, what is the significance of this? Was this made by robots?

Dr. Ambler. This was made at the AMRF, the facility that you saw demonstrated on the VCR during Dr. Lyons' testimony.

Mr. Brown. You didn't answer his question. It was made by robots, wasn't it?

Dr. Ambler. Yes, the AMRF does contain robots, yes.

Mr. Valentine. In other words, if I had gotten here on time, I would have understood that, wouldn't I?

Dr. Ambler. I'm sorry, I thought you had seen the film.

Mr. Valentine. No, I did not.

Dr. Ambler. Oh, excuse me.

Mr. Valentine. Doctor, this cold neutron facility that you talked about, what is the anticipated cost of construction of that facility?

Dr. Ambler. If we're talking in terms of making the maximum use of the facility—this was demonstrated on the slide—the total cost would be about $30 million.

Mr. Valentine. Taking into account these reductions that have been recommended or suggested, is the budget request for 1985—does it exceed the request for the previous year and, if so, by how much?

Dr. Ambler. Yes, sir, it does. I'll give you the figure in a moment.

The 1984 appropriation was $115,718,000; the 1985 request is $126,062,000. So that is a net increase of $10,344,000.

Mr. Valentine. Would you anticipate that there would be any private chattel used in connection with this cold neutron facility or would it be built entirely at the expense of the Government?

Dr. Ambler. Not in the development of the facility nor the experimental rooms, but a number of the ports—that is, the experimental stations that would be built—would be made available to outside users, and then they would instrument that. So the incremental cost of instrumenting it so they can actually do their experiments would be borne by the outside users.

Mr. Valentine. Thank you, Mr. Chairman.

Mr. Walgren. Thank you, Mr. Valentine.

Mr. Gregg.

Mr. Gregg. Thank you, Mr. Chairman.

Just a couple of house-cleaning questions first:

On the—I notice you've got $2 million for a new telephone system which is tied to computers, full utilization of your computers, I guess, because you've got a dial system now and you want a touch tone system; is that the reason?

Dr. Ambler. Well, it's part of it. We do have a dial system. It's a very old system. Irrespective of the computer, we would be asking for this facility, but since we are asking for the facility, it's only common sense to see how one can make use of it as part of the computer network.

Mr. GREGG. Does it make sense, though, to ask for $2 million of telephones when you're eliminating substantive research activities such as fire and buildings?

Dr. AMBLER. Well, I can't emphasize too much how antiquated the telephone system is, how expensive the repairs are becoming, and, indeed, how some of them are getting difficult to effect at all, and those affect all of the programs at the National Bureau of Standards.

Mr. GREGG. Well, on the fire research issue, Dr. Keyworth yesterday said the reason that the fire research was eliminated was because he felt it was a function of the States. Is there a capacity within the States to do the fire research that you're presently doing?

Dr. AMBLER. No, I don't believe there's the capacity in the sense of experimental facilities. What I had meant when I said that it should be done by the State and local governments is that it could be funded by them. There's no reason why facilities at the Bureau could not be used, but it should be funded by the State and local governments. There are perhaps one or two other places where it could be done, also.

Mr. GREGG. Then it would be available to those States that funded it, one presumes, not to other States?

Dr. AMBLER. Well, I would hope that the way it would be arranged would be through some State associations. For example, we deal very comfortably with the National Conference of Weights and Measures when we're dealing with the State sealers, or there should be other State organizations that could pull together the resources of the individual States and make the results of the research available to all.

Mr. GREGG. Do you anticipate that that's a realistic possibility, that the States would—that the State associations or the States would come up with the funding, the $5 million that is being deleted for fire research, $5.1 million?

Dr. AMBLER. Well, the only thing I really have to go on is what happened last year, and on the basis of that, I guess I have to be honest and say that there isn't much evidence to date that it would occur. But that doesn't alter the position that should come up with the funding, and perhaps if they're forced to, they will.

Mr. GREGG. In the computer area, is there a shift going on here as to how you're going to—as to what you're doing relative to—you seem to be going into quality control issues primarily and sort of business standards or industry standards issues; is that correct?

Dr. AMBLER. No, I don't think it's—it's not the way I see it. The quality control standards—was that the first part of your question, sir?

Mr. GREGG. Right.

Dr. AMBLER. No, I don't think that's so at all.

Now the second part dealt with getting into industry standards——

Mr. GREGG. Right.

Dr. AMBLER [continuing]. As opposed to Federal information processing standards. In a sense, I think that is true, but not because we've decided to do the industry standards and not the Federal standards. We have seen that a much more efficient and effective way of getting the Federal job done, the mandate under the Brooks Act, is to involve the private sector more, and to do that you have to involve them in areas where they have their own interests. It is involving the people on the outside who are users of computer systems and, therefore, computer standards as opposed to involving only the manufacturers of computers that has been the biggest change in the last 2 years. It has had a very big effect on our ability to have the private sector work with us to help influence the attitudes of people and help us draft information processing standards that are useful not only to the Federal Government, but to the private sector as well. So they're better standards; they're more efficient standards, and the Federal Government is getting what it is funding through the Brooks Act at the same time.

Mr. GREGG. How about in the robotics area—are you going into quality control there?

Dr. AMBLER. The robotics area—I assume you're referring to this whole area of robotics and the Automated Manufacturing Research Facility?

Mr. GREGG. Right.

Dr. AMBLER. We're going to—quality control for machine parts, yes, and we're doing that because we see that as a natural extension. We see that as we go to the automatic factory, the factory of the future, that the usual type of gauging, off-line gauging, is just completely out of tune and not with the times, the technology. It has to be done on-line, sensed on-line.

So the measurement standards that we provide are going to be provided in a different way as part of the operation, and we would be involved in measurement techniques made on-line and, to that extent, quality control, yes.

Mr. GREGG. Do you think that is appropriate as—versus industry doing it?

Dr. AMBLER. Yes, I do, because I think it's a very natural extension of—well, let me go far enough back to the gauge block. It's the kind of measurement focus and expertise that the Bureau has always provided.

I don't think it—I'm not saying that we would develop every particular type of sensor for every particular type of machine, but we would develop—we would do research on ways that this would be done, so that it would help people who want to either manufacture the machines or manufacture the sensors for machines.

Mr. GREGG. On the Supercomputer that you want to buy, is that going to be used primarily by NBS or by NOAA?

Dr. AMBLER. It will be used by both organizations. I don't have in my mind the breakout of the ratio. Maybe Dr. Lyons has a better feel for the division, the amount of time each of us will use that.

Dr. LYONS. I think it's probably a bit more for NBS than ERL. ERL is split into five organizations, one in Boulder and then there are four regional laboratories. But there will be a heavy load from both. In the case of the computing done in Boulder, that's both NBS and ERL, and then they have these remote sites. All will be coming in for the Supercomputer. All will be piped into Gaithersburg.

Mr. GREGG. Are the calculations and the uses that you're going to use the Supercomputer for, are they—is it necessary to have that level of computer capability or could you do it on a lower computer?

Dr. LYONS. The requirement studies show that over the useful life of this machine, which is of the order of 6 years, 7 years at the outside, that if we didn't purchase a Supercomputer, which by using it in three shifts will be sold out over this period of time, we would have to buy something like eight smaller computers phasing them in over the same time period, and that's just not cost-effective.

Mr. GREGG. Who are you buying the Supercomputer from?

Dr. LYONS. Sir?

Mr. GREGG. Who are you buying it from?

Dr. LYONS. The RFP is a performance specification, so that anyone who is able to build such a machine is at least theoretically able to bid.

Mr. GREGG. Who's able to build such a machine?

Dr. LYONS. Well, in this country there are two major current suppliers. There are other firms who are doing research in the area and who are offering prototypes. There are some manufacturers overseas as well.

Mr. GREGG. Well, do you expect to buy an American machine or an overseas machine?

Dr. LYONS. Well, we'll have to see what the bids are. There's a formula in the RFP that provides—first of all, you have to pass a benchmark in a specified way. If you do better than that, you get a little credit in your bid, and then there's a calculation that's made to see who the low bidder is. Now by low bidder, we mean cost over the life cycle of the machine, so it's not just the initial purchase price.

Mr. GREGG. Have the American companies submitted bids? Are they participating?

Dr. LYONS. No. The bids will close late in March.

Mr. GREGG. Do you expect them to?

Dr. LYONS. Oh, we expect some bids, yes, sir.

Mr. GREGG. From American companies?

Dr. LYONS. I should think so.

Mr. WALGREN. Would the gentleman yield on that subject?

We have $8 million of funding from the Bureau on this computer project?

Dr. LYONS. Eight point nine.

Mr. WALGREN. Is there any funding being asked from other participating Federal levels—NOAA in particular?

Dr. LYONS. Well, the Commerce Department assembled the money all in the Bureau's budget as a matter of convenience, so the NOAA contribution was simply moved into the NBS proposal.

Mr. WALGREN. I see. So there is a recognized contribution from NOAA?

Dr. LYONS. Oh, yes, there's a——

Mr. WALGREN. And how much was that?

Dr. LYONS. I don't have that. Maybe Mr. Kammer does.

Mr. Kammer. The total cost of the machine would be about $19.9 million. Of that, we're asking for $8.9 million in this budget. We already have $8 million from prior appropriations when this issue was discussed about 2 years ago. In addition to that, there'll be a contribution from the NOAA base of about $3 million, and that adds up to——

Mr. Walgren. So of $19 million, the Bureau is coming up with $16 million and NOAA is coming up with $3 million?

Mr. Kammer. Yes, sir, but the $8.9 million appropriation that's requested in our budget, as Dr. Lyons said, was really arrived at with both consideration of NOAA and of NBS.

Mr. Walgren. And how much did NOAA contribute to that consideration in this budget figure?

Mr. Kammer. NOAA's total utilization of the computer is going to be approximately 40 percent of the total, and so a comparable weight I think should be given to the almost $9 million.

Mr. Walgren. And was it?

Mr. Kammer. Since we're all examined in the same budget process, we were all present when the discussion went on, but it wasn't really, well, OK, NOAA's going to contribute this much and NBS is this much. The total cost was arrived at, and then we decided we'd put it in the NBS.

Mr. Gregg. On another subject, you have $8.7 million for technical competence, Dr. Ambler.

Dr. Ambler. Yes. I think that's a line item in the budget. I assume that——

Mr. Gregg. Is that essentially a discretionary fund?

Dr. Ambler. It was funding that was recommended by this committee and appropriated. It wasn't all appropriated in 1 year; it was over a number of years, the focus of which was to allow the Bureau to invest in the long-range basic research that would build scientific competence in areas we believe would be important to the Bureau in the future. It was not discretionary in that it was for long-range basic research. I think the particular areas, I had a good deal of discretion there, but I discussed it with the staff members, and you've had reviews of that.

So I hope that's responsive.

Mr. Gregg. So, you don't perceive it as discretionary, as a discretionary fund to be applied to those programs that you think might——

Dr. Ambler. Well, I think I would regard it as discretionary in the sense that, if it's spent for long-range basic research, if it's in an area where I can make a good argument that this is an area that the Bureau ought to be strong in for the future. I have some discretion to pick research area A over research area B. I don't have the discretion to use it for something completely different.

Mr. Gregg. How about fire research?

Dr. Ambler. No, I don't think it really fits that area. We already have competence in fire research, and these funds were to build competence where it didn't exist. So I don't think it would be appropriate to use it for fire research.

Now Mr. Kammer just pointed out to me—I did, in making assessments as to where this funding should go, I did think there were certain areas of fire research that needed to have certain competences, and I did fund a research project there to the tune of $267,000 which had to do with the basic chemistry of soot formation. That happens to be a very important question when you consider things like visibility in fires and the mechanism of the formation of the soot and the point where the soot gets to the point where you cannot see through the smoke which is not very well understood from the basic chemistry point of view. So I funded that.

In other words, from the point of view of competence, building competence in areas that we don't have it at the present time, I don't see fire as any different from any other of the programs at the Bureau.

Mr. GREGG. Thank you.

Mr. WALGREN. The Chair would recognize the gentleman from New Mexico, Mr. Skeen.

Mr. SKEEN. You New Englanders all stick together here.

Dr. Lyons, I notice this $3 million line item on biotechnology, establishment of a new program. I was just curious, what are your personnel requirements and who do you have aboard now in these disciplines or in this?

Dr. LYONS. That is for Dr. Johnson, I believe.

Mr. SKEEN. Dr. Johnson? OK. Excuse me for——

Dr. JOHNSON. That request for an increase is in my area. Perhaps I can address that.

Mr. SKEEN. Excuse the slight, then, Doctor. We'll retire Dr. Lyons and we'll put you aboard, then.

Dr. JOHNSON. We have been involved in related areas here for quite some time, as I mentioned in my testimony. So we're building on a base of expertise. We've been involved in clinical chemistry for more than 15 years, and we at the present time have about 80 biological and clinical and nutritional SRM's that we are currently marketing.

We have also been building competence in this area using some of our competence-building funds. So we have a total of maybe 20 people working in this area now.

Our intention is to hire some people with the expansion funds. They will be largely biochemists and people with chemical backgrounds who can provide us with the kind of expertise we need for the chemical end of standardization.

Mr. SKEEN. Thank you, Doctor. But given the newness of this particular area of interest, where do you find these people?

Dr. JOHNSON. Well, it is possible to find them. On the other hand, the market is rather limited. There are a few degree-granting programs in special areas of chemistry and biochemistry in the country, but not many.

We have been working very directly with the University of Maryland. In fact, we are developing plans with them to cooperate very closely with them in their educational program in biotechnology because there clearly is a shortage there. We intend to take advantage of the biological expertise that Maryland has on their staff, combine it with our chemical expertise, and make up biochemists from one part biologist and one part chemist.

We are planning, also, a——

Mr. SKEEN. That's a new hybrid, huh?

Dr. JOHNSON. That's right.

We are also planning a joint effort with the University of Maryland that we hope to locate right near the Bureau of Standards at Shady Grove. That's something that's under negotiation right now. It's not finalized in any way, but we are looking into that possibility.

Mr. SKEEN. What other institutions can you find it throughout the United States? Do you have any close liaison with them other than Maryland or——

Dr. JOHNSON. Well, most of our——

Mr. SKEEN. This is a tough new area——

Dr. JOHNSON. Yes.

Mr. SKEEN [continuing]. To develop a discipline.

Dr. JOHNSON. Most of our contacts in biotechnology have been with industry. We've been working very closely with DuPont, in particular with the individuals who have been designing the new DuPont Life Sciences Center. We've been working with Genex, which is a local corporation to us, and with Litton Bionetics. We've been working directly with NIH in a collaborative way. So all of these people have had input to us in the planning of our program, and they're helping us get leads on people that we might be able to hire, so that we will be in a position to expand if resources are provided.

Mr. SKEEN. You're sort of developing, all developing this system together, then, as I gather?

Dr. JOHNSON. Yes.

Mr. SKEEN. With industry, the educational community, and the Bureau?

Dr. JOHNSON. That's right.

If the program is to succeed for us, we must work closely with industry.

Mr. SKEEN. You have 14 slots open now, according to this proposal. You lack—have you got 14 people designated out of the 28 that you're talking about?

Dr. JOHNSON. No, sir, we do not.

Mr. SKEEN. You do not?

Dr. JOHNSON. This expansion is a proposed expansion——

Mr. SKEEN. I see.

Dr. JOHNSON [continuing]. For fiscal year 1985.

Mr. SKEEN. Also, one last question, how do you set standards for an industry that's just getting started like that, like this?

Dr. JOHNSON. Well, some aspects of the industry, sir, are already established. There are now a significant number of products on the market in the pharmaceutical area and clinical area, as I mentioned earlier.

The kind of problems that industry is bringing to us are problems really related to standardization and research. They need help, for example, with basic data. They need help with measurement methods, so they can characterize biologically active molecules, so they can identify the products of their genetic engineering.

So the needs for standards are developing as the field is developing.

Mr. **Skeen**. How many SRM's have you published or issued now for—how many products involved? Just give me some general idea because I'm curious as to how extensive——

Dr. **Johnson**. Well, we have at the moment, as I mentioned——

Mr. **Skeen**. Have you been issuing SRM's?

Dr. **Johnson**. We have about 80 SRM's that have applications in this general area. We also have a fairly substantial amount of standard reference data that we have generated that is now being used by the industry. We are in the process now of producing a new standard reference material that will be a marker system for calibrating protein detection systems. So we're involved in the business, but not at the scale that industry demands.

Mr. **Skeen**. Thank you very much, Dr. Johnson.

Thank you very much, too, Dr. Lyons.

Thank you, Mr. Chairman.

Mr. **Walgren**. Thank you, Mr. Skeen.

I had several other points I wanted to at least touch on.

Dr. Lyons, in the automated manufacturing research area, how much of that—that's a $6 million program; is that correct?

Dr. **Lyons**. Yes.

Mr. **Walgren**. How much of that is focused on robotics per se?

Dr. **Lyons**. Well, Mr. Chairman, of course it depends a little bit on how we define robotics. But if we define it as I think the subcommittee wishes, we have $1.5 million of direct appropriations and we have another $200,000 from other agencies or industry, plus about one-half of a million dollars of matching in-kind contributions from industry.

Of the $6 million, $1.5 million is in what you strictly define as "robotics."

Mr. **Walgren**. And then what would the balance of it—how—what would the description of the use of the balance be, other than robotics?

Dr. **Lyons**. Well, it's all of the work on interface standards for interconnecting the machines. It's the work on the metrology for the factory of the future, the things that Dr. Ambler was describing whereby we try to develop ways of characterizing each of the machines and modeling the errors in those machines and providing the basis for industrial quality control.

Mr. **Walgren**. OK. All right. Turning to the telephone system and the $2 million item for that, why is that not part of a larger generic category called equipment?

Mr. **Kammer**. Because it's an alteration of our facilities, sir, and the way NBS money has been appropriated traditionally a distinction is made between facilities and real equipment on the site.

Mr. **Walgren**. Would you speak into the microphone a little bit more directly? I'm sorry.

Mr. **Kammer**. It's because it's an alteration of the facility itself, the real estate and the buildings, and traditionally in our budget a distinction has been made between bricks and mortar and electrical systems in the buildings and technical equipment.

Mr. **Walgren**. I see. OK.

Dr. Johnson, if I could ask you to help us a little bit on the phaseout of the measurement assurance program, it seems that what you're going to in increasing the effort in calibration is very close to the measurement assurance function. What is the distinction between what you want to be doing in this increased effort in calibration, quality of calibration processes, and what we are doing in the measurement assurance program?

Dr. **Johnson**. Mr. Walgren, let me begin by trying to point out the difference between a calibration service and a measurement assurance program. With a traditional calibration—we offer 154 different types of calibrations at the present time—a customer will send an instrument to us, we will calibrate that instrument against our standards in our laboratory. We will issue a certificate of that calibration. That sort of calibration is typically adequate for field use. We will then ship that instrument back to the customer and he's on his own.

With a measurement assurance program, we offer a much higher level of service. It's a special delivery, so to speak, where we first develop and refine a calibration service in the area. Once the calibration service is developed and documented carefully, we then develop transfer standards. The transfer standards remain in NBS ownership. When a customer seeks our service, we calibrate a transfer standard for him, one of ours. We ship it to him. We instruct him over the telephone, in some cases in person, on how to transfer the calibration from that transfer standard to his own standard in his laboratory. Once that is completed and is documented, he then ships the transfer standard back to us. It's a round trip. We can that way insure that our transfer standard was working at the other end when it was used in his laboratory.

After we're finished and the whole process is statistically analyzed, we then issue them a certificate of calibration, this time for their whole laboratory. We're calibrating the performance of their equipment in its own home environment, also calibrating the performance of their staff as they use that equipment. It is a very high level of service.

We are now offering only eight measurement assurance programs, and I compare that with 154 different calibration services.

Now it's true that we continue to improve and refine our calibration services in all areas, to try to keep pace with the state of the art, but one might liken the measurement assurance program to a special delivery and the calibration service to a regular delivery. It is, indeed, a very specialized kind of service.

Our proposal for increase in the quality assurance area really deals with new calibration services that we're not now offering. So it's quite different than MAP's.

Does that help answer your question?

Mr. **Walgren**. Yes.

What's our experience with the measurement assurance program when we increase the fees? Am I right in thinking that at some point we were not charging the operating expenses, or however you want to describe the cost to deliver the services as opposed to the cost to create the service in the first place, and then we started user fees in this area. Is that correct, or did we always have user fees?

Dr. **Johnson**. We have always had user fees in the area of measurement assurance programs. We charge the customer for the cost of maintaining the service and delivering it to them. We do not charge them for the cost, or have not in the past charged them for the cost, of research and development of a new service.

Now just this past October, following the instructions by Congress, we increased our prices in the measurement assurance program area by about 20 percent. It's really too early to tell what the results of that increase are going to be, but we certainly have experiences with increases in other areas that we can share with you in a preliminary way now, if you like, and we'll be prepared, as Dr. Ambler indicated, by approximately May 1 to deliver you a detailed report on our attempts to establish pricing structures for our services.

Would you like more information now or——

Mr. WALGREN. Perhaps you could submit it to us in some written form. I don't know that I can constructively explore that any further.

[Material to be supplied follows:]

NBS AUTHORIZATION HEARINGS
HOUSE SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE

2 FEBRUARY 1984

CHARGES FOR NBS SERVICES: PRELIMINARY OBSERVATIONS ON EFFECT OF PRICE INCREASES

NBS performs research and disseminates the results of this research through a wide variety of means. The products of this research include: primary standards, new and improved methods of measurement, transfer standards, and quality assurance procedures. Research results are disseminated primarily through publications, NBS staff participation in hundreds of voluntary standards activities, professional and scientific societies, calibration services, and standards reference materials (SRMs). Of the many avenues of dissemination, two, SRMs and calibration services, entail transaction points and are offered on a fee basis. These two services are used in quality assurance systems involving trade (e.g. buyer-seller agreements, military purchase specifications), public health and safety (e.g. reliability of clinical tests, performance of diagnostic and therapeutic radiation devices, occupational exposure to chemicals and radiation), and technology development (e.g. process control, instrument development, and materials development). Calibration services and SRMs represent a direct means by which sophisticated measurement technology developed by NBS is transferred to tens of thousands of large and small users in industry, hospital, state, and Federal laboratories. Domestic and international commerce involving hundreds of billions of dollars of goods and services are tied to NBS measurement services.

During the past three years, NBS has made a number of price adjustments and conducted pricing experiments to determine the factors involved in balancing revenues derived from delivery of services to maximize benefits to the public. Based upon the price-change experience to date, several generalizations can be made regarding effects upon the customer and customer reaction.

- Small businesses, small laboratories, hospitals, and state and local government laboratories are less able to accommodate to price increases than large businesses. Much of this difference is attributable to differences in rates of inflation adjustments to quality assurance budgets of customers. Thus, price increases result in only small gains in net income to NBS. Fewer customers are served, with the customer mix shifting toward maintenance of services to larger customers and declining services to smaller customers.

- Price increases have a highly elastic effect in the year they are imposed: dollar volume of sales remains roughly constant with the number of sales reduced in proportion. The negative impact of lengthened calibration intervals on customer quality assurance systems is not yet well documented, but it is clear that most customers, particularly the larger ones, require more frequent calibration and seek to "catch up" to earlier levels of service. If price increases exceed inflationary rates, customers do not catch up and procedures involving fewer quality assurance checks tend to be used.

- NBS offers 154 different types of calibration services with an average income per service of $22K per year. Many new services are currently required by industry to keep pace with technological development, but are not now provided by NBS. The average R&D cost to develop one of these new services is approximately $500K. Many-fold price increases would be required without reduction in sales in order to provide the resources needed for the development of new services. It is clear that the income from a given calibration service is too sensitive to price to be considered a practical source of revenue to fund development of new services. In the SRM area, our average income per SRM is $4.5K per year and the R&D cost for a new SRM is approximately $200K per year. Again, the need for many new services has been well documented by the industries we serve. A many-fold increase in the price of SRMs would be required to produce enough income to develop new services. The conclusion here is the same as the conclusion in calibrations: increased charges to the current set of customers will not produce the revenues required to support R&D for new services.

- NBS has close communications with its customers, and has frequent personal contact. It has become increasingly clear that our customers feel that price instability makes it difficult for them to plan their quality assurance programs and associated budgets.

Later in the year, NBS will submit to Congress a more detailed analysis of price increase on NBS services and their effect on customers as well as the impact such increases may have on the quality of products in commerce.

Mr. **Walgren**. Have you seen any decrease by small users when you increase the prices?

Dr. **Johnson**. Perhaps the area where we have the best data is standard reference materials, where we have been adjusting our prices on an annual basis approximately at an inflationary rate for about the last 5 years. And if you look carefully at the market mix in the sale of reference materials over that period, you indeed tend to see a change in the mix. The larger companies seem to be able to handle the price increases better than the small companies do, and we do lose small companies in the process.

We find particularly that State and local governments, who are dependent upon our service for regulatory enforcement reasons, find it very difficult to deal with the increases in price.

On the other hand, we've tried a significantly larger increase in price at the beginning of fiscal year 1983 in standard reference materials, about 22 percent across the board, and there we found a very significant decrease in sales in all areas, not just the small customers but in all areas.

So I think it's fair to say that our customers appear to have approximately a fixed number of dollars that they will spend with us, they have budgeted for measurement services, and that if we increase our prices at roughly an inflationary rate, they can increase their budget at roughly the same rate to accommodate the change. If we make an increase that is larger than that, they simply decrease the amount of service they purchase from us.

If it's in standard reference materials, they make the samples last longer. If it's in calibrations, they make their calibration intervals a little longer to accommodate for it.

I think the question that one must really address is where do we draw the line so that we are really performing our mission function and at the same time optimizing the income that we return to the program from the sale of these services. We're struggling with that issue, and we'll report to you in detail.

Mr. **Walgren**. To the degree that they do not use your services, the result is a greater degree in latitude in the products that are out there?

Dr. **Johnson**. Yes, sir.

Mr. **Walgren**. And if that is a negative factor, the commerce in that product would be diminished and hurt, would it not?

Dr. **Johnson**. Yes, sir. We feel that there will certainly be a long-term effect. On the other hand, it's very difficult to demonstrate effects in the short term. We tend to take a look at these processes in the short term. I think the long term effects could be serious.

Mr. **Walgren**. I see.

That's a hard line to draw. I think we should ask you if you would give us development of your experience on those last points that you covered. We'd be interested in how you wrestle with that problem, because it does strike me that—I mean it would strike anyone that—to the degree that we are not eliminating error factors, the future development and the future use of whatever products are made with large error factors would be more limited than it would otherwise be. And it would strike me as very much in the Bureau's mission to maximize the accuracy of our products in this society, so that they can be put to the maximum use.

Well, I'd appreciate the development on that.

[Material to be supplied follows:]

NBS AUTHORIZATION HEARINGS
HOUSE SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE

2 FEBRUARY 1984

EFFECT OF EXTENDING CALIBRATION INTERVALS ON PRODUCT QUALITY

Accurately calibrated transfer standards and Standard Reference Materials are used to calibrate and control measurement processes throughout industrial development and production. In particular, accurate measurements are an important component of industrial quality control systems. Measurements are used to evaluate the attributes of products relative to quality specifications and to control production process parameters, which determine the performance and quality of products. Measurements are used to evaluate quality during production itself and also in post-production inspection. The production of many products, such as electronic and communication systems, is very measurement intensive - more than 20% of the final value of these products is added by measurement. Thus assurance of accurate measurements is critical to industrial productivity and quality control.

The performance of measurement instruments is influenced by many factors, including environmental parameters e.g. temperature, moisture, dust, and electric, magnetic and ionizing radiation. Just as musical instruments have to be returned periodically, measurement systems must be recalibrated before they reach the point that their errors begin affecting product quality or performance. It is difficult to determine the optimum calibration interval for a giver instrument because instrument performance depends on so many factors including environmental, rate of use, and operator technique. Most operators will calibrate equipment at specified intervals based on past experience for that particular kind of equipment.

If calibration intervals are lengthened without sound technical knowledge that the instrument has attained greater stability, the operator is taking a considerable risk in terms of guaranteeing the quality and performance of end products. Sophisticated measurement systems may "drift" very slowly so that the operator may not notice when the instrument goes out of calibration. The gradual deterioration of the product itself will also go on until customer complaints require corrective action to be taken. There is an aspect of playing "Russian Roulette" in arbitrarily increasing calibration intervals for non-technical reasons such as not being able to afford to calibrate more often.

We do have some preliminary data from past price increases for NBS measurement services indicating that many customers have a fixed budget for calibrations and/or Standard Reference Materials, at least in the short term. Customers tend to reduce their use of NBS services by about the same percentage as the NBS price increases by extending the interval between calibrations. This could lead to a gradual deterioration in both the quality of the measurement and the product it is controlling.

Mr. **Walgren**. Counsel to the minority?

Ms. **Bach**. Dr. Johnson, on the line of the MAP's program, could you say whether it is or is not true that the people who have requested the MAP's program have been companies such as Lockheed, Simco Electronics, microwave companies, that I would not classify as small business?

Dr. **Johnson**. I don't have a list of the companies with me at the moment. We certainly can submit those to you. But several of the companies you've mentioned have been our MAP customers. Many of the MAP customers are large companies that operate large metrology laboratories and have a need for this very specialized high level of service.

[Material to be supplied follows:]

NBS AUTHORIZATION HEARINGS
HOUSE SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE

2 FEBRUARY 1984

NBS MEASUREMENT ASSURANCE PROGRAM CUSTOMERS

Attached are lists of NBS Measurement Assurance Program (MAP) customers during the last two years. MAP users are located throughout the United States. They are concentrated in the industrialized states - particularly those that have large numbers of high technology and defense related companies and federal installations e.g. California, New York, New Jersey, Texas, and Pennsylvania.

Nearly half of all MAP users are in the defense and/or aerospace industries or are agencies of DoD. There are also a number of small companies and state/local government laboratories using MAPs. State and local governments are particularly heavy users of the Watthour Meter MAP, which provides the accuracy basis for meters used to monitor electrical power consumption throughout the United States.

The University of Wisconsin has been the only university that has recently used a MAP service. However other MAP users, e.g. the Jet Propulsion Laboratory, do have strong ties to universities. NBS has also developed servicers similar to MAPs in other areas such as for ionizing radiation measurements. Many users of those services are university and non-defense companies.

ELECTRICAL RESISTANCE MAP

Dept. of the Army (Redstone Arsenal)

Beckman Instruments, Inc.

Boeing Aerospace Co.

Eastman Kodak Co.

Electrical Standards Repair Service, Inc.

Hughes Aircraft Co.

Lockheed California Co.

Martin-Marietta

Mill-Power Supply Co.

NASA (Houston)

NASA (Kennedy SC)

Dept. of Navy (DC)

Dept. of Navy (San Diego)

Rockwell International

TRW, Inc.

ELECTRICAL CAPACITANCE MAP

Dept. of the Air Force (Newark)

Beckman Instruments, Inc.

Electrical Standards Repair Service, Inc.

GenRad, Inc.

Lockheed California Co.

NASA (Houston)

NASA (Kennedy SC)

Rockwell International

Sandia National Laboratories

TRW, Inc.

STANDARD VOLT TRANSFER MAP

Dept. of the Air Force (Newark)
Dept. of the Army (Redstone)
Dept. of the Army (White Sands)
Boeing Aerospace Co.
Eastman Kodak
General Electric
Hewlett-Packard
Hughes Aircraft Co.
IIT Research Institute
John Fluke Mfg. Co., Inc.
Leeds & Northrup Co.
Martin Marietta
NASA (Houston)
NASA (Kennedy)
NASA (Langley)
Naval Avionics Ctr. (Indiana)
Dept. of the Navy (DC)
Dept. of the Navy (San Diego)
Pratt & Whitney Aircraft
Siemens-Allis
Union Carbide

DC VOLTAGE REGIONAL MAP

LOS ANGELES AREA

- Beckman Instruments
- Electrical Standards Repair
- Lockheed California Co.
- Rockwell International
- TRW, Inc.

SAN FRANCISCO AREA

- Hewlett-Packard
- Lockheed Missiles & Space Co.
- Pacific Gas & Electric Co.
- Simco Electronics
- Systron Donner

LOS ANGELES AREA

- ASCO Laboratory Corp.
- Ford Aerospace
- General Dynamics
- Jet Propulsion Laboratory
- Teledyne Systems Co.

NEW JERSEY AREA

- Grumman Aerospace Corp.
- Guildline Instrument, Inc.
- Lockheed Electronics
- RCA
- Standard Reference Labs., Inc.

TEMPERATURE (PRT) MAP

- Dept. of the Army (Redstone)
- Mill-Power Supply Company
- Dept. of the Navy (San Diego)
- Pratt & Whitney Aircraft
- TRW, Inc.

MASS MAP

Dept. of the Air Force (Newark)

Dept. of the Army (Redstone)

Bendix Corp.

County of Los Angeles

Lockheed Missiles & Space Co.

Mettler Instrument Corp.

3M Company

Monsanto Research Corp

NASA (Houston)

Dept. of the Navy (San Diego)

Rockwell International

Sandia National Laboratories

TRW Inc.

GAGE BLOCK MAP

Beckman Instruments, Inc.

Lockheed Missile and Space Co.

Ford Aerospace

Duke Power Co.

WATTHOUR METER MAP

Central Power & Light Co. (TX)

Cleveland Electric Illuminating Co. (OH)

City of High Point (NC)

City of Seattle (WA)

City of Tacoma (WA)

City Public Service Board (TX)

CMS Testing Labs (IA)

Colorado-UTE Electric Assoc., Inc.

Consumers Power Co. (MI)

Corn Belt Power Corp. (IA)

Dallas Power & Light Co. (TX)

Florida Power Corp.

General Electric Corp.

Georgia Power Co.

Houston Lighting & Power Co.

Metropolitan Edison Co. (PA)

Mill-Power Supply Co. (NC)

Minnesota Power & Light Co.

Nebraska Public Power District

New Orleans Public Service

Northern States Power Co. (MN)

Ohio Edison Co.

Otter Tail Power Co. (MN)

Pacific Power & Light Co. (OR)

Pennsylvania Power & Light Co.

Public Service Co. of Oklahoma

RFL Industries, Inc.

Savannah Electric & Power Co.

SMR Associates, Inc.

So. Carolina Electric & Gas Co.

State of California

Tampa Electric Co.

Texas Power & Light Co.

Tri-State Generation & Transmission Assn., Inc.

Tucson Electric Co.

Tennessee Valley Authority

University of Wisconsin-Madison

West Texas Utilities Co.

Wisconsin Electric Power Co.

LASER POWER MAP

Dept. of the Air Force (Newark)
Boeing Aerospace Co.
Burroughs Corp.
Coherent, Inc.
Harshaw Chemical
Honeywell
IBM Corp.
Lockheed Missiles & Space Co.
Dept. of the Navy (Pt. Mugu)

Dept. of the Navy (Pt. Mugu)
Northrop Corp.
Rockwell Int'l. (Canoga Park)
Rockwell Int'l. (Anaheim)
Sandia National Laboratories
Spectra Physics
Sperry
Xerox Corp.

Ms. BACH. Would it be also true that in your proposal for eliminating the MAP—well, actually it's not correct that your MAP's capacity is eliminated; you will still maintain that capacity at the laboratory, should it be requested and should a company come in with the proper matching funding for that program?

Dr. JOHNSON. That's right. If a company or trade organization comes to us or if another Federal agency comes to us and requests a MAP to meet their specialized need, we will be prepared to deal with it.

Ms. BACH. Is it also true that in decreasing the MAP's facility that you are also intending to reprogram funds into calibration services that companies can use to come to the Bureau and receive the same amount of service as they would presently have required under the MAP program?

Dr. JOHNSON. Well, if the funds are eliminated from our budget in 1985, then certainly it would not be possible to make that kind of reprograming. Some of our customers have suggested to us that, as an alternative to the funds being removed, they would prefer to see them reprogramed to support existing calibration services.

Ms. BACH. Is the fiscal year 1985 budget not requesting funds for increased calibration?

Dr. JOHNSON. Yes, we are requesting funds for increased calibrations, but those funds are to be focused on developing new calibration services that we do not now offer.

Ms. BACH. And with regard to the SRM's, are you still seeking legislation that would allow you to recoup some of the investment in that research?

Dr. JOHNSON. We are not at the present time proposing legislation to you. We, of course, did propose that legislation last year. The Administration is considering a legislative proposal in this area, and it has not yet been brought forward.

Ms. BACH. Thank you.

Mr. WALGREN. Mr. Burrows, with respect to the computer reductions, is it my—is my understanding correct that one of the things that we will not be pursuing in the Bureau is the ability to give expert technical help or function as a resource for other Federal parts of the Government that have computer problems and the like?

Mr. BURROWS. That is true that the basic laboratory structure which we fund in which we get the basic technology that we take out and help people with, a good lot of that will disappear unless there is a way for the Federal users to pay for the basic cost of developing the expertise in the first place. I doubt whether they—they usually do not pay for that. They pay for using technology once you've learned it, but they don't pay for you going to school. So I think it would gradually wither away.

Mr. WALGREN. And where would they have to go for that kind of help at that point?

Mr. BURROWS. They would have to find an alternate source. I don't know.

Mr. WALGREN. The alternate source would be in the private sector someplace?

Mr. BURROWS. Yes, except many of the things which they ask about, and even we don't get paid for, they just ask, are not things which they would reveal to the private sector, nor could they go through contracting rapidly enough to get it done.

Mr. **Walgren**. I see.

One of the criticisms generally of the Government is that it is unable to use new technology well and, therefore, we fail in our functions. I guess the downside of that kind of change is that we would be limiting our ability to perform well as a Government in a host of different agencies if we did not keep this kind of resource together in a very accessible place in the Federal Government. Is that a fair statement?

Mr. **Burrows**. Yes, I would say that we've been spending the last 3 to 5 years building this ability up, and we're now just—I think you're right, it will not be available anymore.

Mr. **Walgren**. And, then, let me just ask briefly, Dr. Reneker, the whole area of materials research, of course, is a multifaceted thing. It goes on in so many other areas as well, as I understand, in the Department of Energy and other places. How do you coordinate the materials efforts or select the materials effort that the Bureau would properly make compared to what else is happening in other governmental science research places?

Dr. **Reneker**. Well, of course, we spend a reasonable amount of effort being in touch with what's going on in the other materials laboratories in the Government, and particularly in industry. We have been involved in several large coordinating activities. I didn't mention rapid solidification processing, but that's one where through COMAP we were involved; and similarly in welding, the coordination there with the industry, the Welding Research Council, the American Welding Society, and again under the auspices of COMAP, and with the involvement—I didn't mention it, but—of other Government agencies. So it's a kind of consensus process that involves a lot of back and forth amongst a lot of different people. I think it's a very sound process.

Mr. **Walgren**. Well, with that, let me thank you all for coming and representing the Bureau today. You've given us some contact points that we can use in pursuit of more information as we try to discharge our responsibilities.

I would like specifically to ask, Dr. Ambler, for your cooperation in this—in the interest of the committee or as the committee pursues its interest in the utilization of facilities. On our part, I think we want to have some independent judgment of how the facilities are being used. We want to both encourage and be supportive of you in pushing for the fullest utilization of facilities, so that we're not as a Federal Government subject to any criticism for having resources which are not delivering the maximum that they can to the public.

Well, thank you very much. We appreciate your time and your coming.

The next witness is Dr. William Slichter, chairman of the Board of Assessment of the National Bureau of Standards Programs, with the National Research Council. Dr. Slichter is also the executive director for Research, Materials Science and Engineering Division of the Bell Telephone Laboratories, and I don't even know what company that is any more. Is that American Bell or is that——

Dr. **Slichter**. It has a name: AT&T-Bell Laboratories, but Bell Laboratories for short.

Mr. **Walgren**. OK. Well, welcome to the committee, Dr. Slichter. We appreciate your coming, and we appreciate that you have some time constraints.

Any written submission that you would like the committee to have as a resource will be made part of the record as a matter of course, and please proceed with outlining the points that you feel should be of special interest.

STATEMENT OF DR. WILLIAM P. SLICHTER, CHAIRMAN, BOARD OF ASSESSMENT OF NATIONAL BUREAU OF STANDARDS PROGRAMS, NATIONAL RESEARCH COUNCIL, AND EXECUTIVE DIRECTOR, RESEARCH, MATERIALS SCIENCE AND ENGINEERING DIVISION, BELL TELEPHONE LABORATORIES, MURRAY HILL, N.J.

Dr. **Slichter**. Thank you, Mr. Chairman. I'm certainly honored to be invited to appear before this subcommittee to discuss my views on some of the technical activities of the National Bureau of Standards. Indeed, my written testimony has been submitted and, with your permission, I'll offer just some highlights orally.

The National Research Council has had this function of evaluating the operations and activities of the Bureau of Standards going back as far as 1959. The work of the panels is in the form of annual written reports on the various centers and offices in the Bureau, which are issued after review by the National Research Council, and in its name, and are delivered to major governmental bodies, including appropriate committees of Congress. These are public reports.

I'd like to interject at the beginning that we of the assessment panel groups, numbering about 200 at any given time, really have the greatest enthusiasm for the quality and expertise of the Bureau, for the skill and dedication of its people, and for its extraordinary place in U.S. commerce, industry, and academia.

There are several issues contained in the President's 1985 budget that concern the Board of Assessment. Our greatest concerns, I think, are with some very large program cuts in the budget that you've been deliberating on this morning, notably the Federal funding for the Center for Fire Research and the Center for Building Technology.

The foregoing reductions that appear in the budget have resulted from budget priorities formulated with particular concern for areas where the Federal Government may be undertaking efforts that are more properly the role of the private sector and State and local governments.

The Board of Assessment appreciates the importance of avoiding activities in NBS that more properly belong outside, but believes that the programs cited here lie well within areas where the Bureau is singularly competent.

The $5 million-plus reduction in funding for the Center of Fire Research is potentially a grievous loss to the public. This Center is carrying out a lot of research to get scientific and technological information on fire hazards, combustion processes, the reduction of fire losses, and the protection of people.

Fires have always been tremendously damaging, and nowhere more so than in this very high technology country of ours. Fires remain so to this day.

The Center for Fire Research has been a unique contributor to the field of fire safety research. The programs have brought about much better understanding of basic fire phenomena and a means to reduce losses and the costs of fire protection.

The NBS Center has developed test procedures for determining the flammability of fabrics and furnishings. Studies have been conducted on the characterization and movement of smoke. Other work is aimed at screening materials for the toxicity of their combustion products. The Center has also made excellent contributions to the use of computer modeling to study ignition and propagation of smoldering combustion.

The private sector has carried out some important research on fires. This work has, however, been specifically directed to special technologies, such as new detectors, special communications methods to send alarms, and specific techniques for extinguishment.

It has been said that this sort of research being done by the Bureau of Standards should be left to the private sector and local governments. The Board of Assessment believes, however, that the Center for Fire Research does a unique job, has a unique set of functions which are scientifically and technologically beyond the capabilities of private or public activities. We believe that this activity is highly cost effective and, further, that the programs provide inestimable protection to life and property. Therefore, we strongly urge that the funding be restored to the Center for Fire Research.

A similar situation exists with respect to the Center for Building Technology, which is also destined to be discontinued under the budget. Programs of this Center have unique value to consumers and the general public and cannot and will not be done by industry. The building industry itself is fragmented into a great many separate technologies, most of which are highly specialized.

Much of the work that the Center for Building Technology does is general in character and cuts across diverse fields. The Center also maintains expertise in analysis and metrology closely coupled to the special needs of the building industry and of government at all levels.

The results of this research at the Bureau form an important and ever-increasing fund of information used to improve Federal, State, and local government codes and specifications. The industry and the public benefit through reduced cost of building, greater reliability and durability of buildings, and enhanced safety of construction.

If these research programs were to be discontinued, the building industry would be incapable of developing a comparable broad and authoritative resource.

Let me move on to the new programmatic initiatives that you've heard from Dr. Ambler and his colleagues. The Board of Assessment enthusiastically supports the three major initiatives contained in the budget; namely, biotechnology, measurement service, and cold neutron facilities.

The proposed initiative in biotechnology is a timely introduction of the Bureau's intrinsic skills into one of the most active new areas of science and technology, an area that is already plainly important to U.S. industry and commerce and that is even now becoming highly competitive on the international scene.

Similarly, the proposed initiative in fundamental physical measurements and standards addresses major needs in industry and Government agencies. The intent is to strengthen greatly the measurement science base, including efforts on process and quality control, and to provide new standards implementation and measurement methods.

The third proposed initiative, the development of a facility for cold neutron research on materials, is a major step in providing the United States scientific and technological communities with new and greatly advanced capabilities to study the properties, performance, and processing of materials, a facility which does not now properly and adequately exist in this country.

Thank you again, Mr. Chairman, for the opportunity to testify here. I'll certainly be glad to respond to questions.

[The prepared statement of Dr. Slichter follows:]

National Research Council
Washington, DC

Statement of
WILLIAM P. SLICHTER
Chairman
Board on Assessment of Programs of the
National Bureau of Standards

Before the
Subcommittee on Science, Research, and Technology
Committee on Science and Technology
U.S. House of Representatives

On Authorization of Appropriations for the Activies of
The National Bureau of Standards

February 2, 1984

Introduction

I am honored by the invitation to appear before the U.S. House Committee on Science and Technology to discuss my views on the technical activities of the National Bureau of Standards (NBS). I speak in my capacity as Chairman of the Board on Assessment of NBS Programs. I am here both as an industrial scientist and as a representative of about 200 members of the various Assessment Panels.

Since 1959 the National Research Council has provided a continuing evaluation of the functions and operations of the National Bureau of Standards. In discharging this responsibility, the National Research Council selects and appoints members to a series of Panels under the Board on Assessment of NBS Programs. The Panel members are formed from leaders in a wide range of scientific and engineering fields. They are broadly representative of industry, government, and academia. The term of a Panel member is usually three years and never more than six years. Panel members are reimbursed for travel expenses, but receive no pay. The scientific and technological communities have responded willingly to the calls for this expert service. Over the years, more than 1,000 technical experts have belonged to the Panels.

It is the responsibility of the Panels to review and evaluate the technical functions and operations of NBS. They consider importance and relative priority of projects, quality of staff, equipment needs, finances, and the relation of the program to the mission of the Bureau. They provide a continuing contact between the scientists and engineers of the academic and industrial communities and the Bureau staff. There are Panels for the major technical organizational units of NBS: The National Measurement Laboratory, the Institute for Computer Sciences and Technology, and the National

Engineering Laboratory. These Panels examine broad technical policy. In addition, they review and coordinate the work of a number of subpanels that look at specific program areas. There are currently 15 of these latter panels, which are charged with visiting the Centers and Offices of NBS.

Among the general questions addressed by the Panels are the following:

1. Do research plans and programs address critical technical issues within the scope of the mission of NBS?
2. Is the research work appropriate and effective in reaching the objectives of the programs?
3. Is the research work of high quality and at the state of the art?
4. Are the available facilities and equipment adequate for the conduct of the work?
5. Is the work well planned and well led?
6. Is the professional staff appropriate in skills and adequate in numbers to meet the responsibilities of NBS?
7. Is the dissemination of technical results to the scientific community, industry, and the general public satisfactory?

Guidance and general oversight to the Panels are provided by the Board on Assessment of NBS Programs. The membership of the Board is comprised of the chairman of the Panels for each of the major organizational units of the Bureau and additional members. Specifically, the Board reviews and coordinates efforts of the Panels, identifies major problem areas in the technical programs, and draws attention to the issues that are common to several organizational units. It is also the Board's responsibility to identify problems and issues that, in its opinion, should be called to the attention of the Statutory Visiting Committee, which reports to the Secretary of Commerce.

Each Panel is asked to prepare a written report. These reports are then collected and, after appropriate review by the National Research Council, delivered to the Director of the National Bureau of Standards, the Department of Commerce, the Office of Mangement and Budget, the General Accounting Office, the Library of Congress, and appropriate committees of the Senate and the House of Representatives. They are also available to the public.

CONCERNS OF THE ASSESSMENT BOARD

Several issues contained in the President's FY 1985 Budget concern the Board on Assessment and its Panels.

Our greatest concerns are with the very large program cuts in the Budget, especially the elimination of direct Federal funding for the Center for Fire Research and the Center for Building Technology. My grave doubts about the drastic actions are discussed in greater detail below. The Board is also alarmed by the large reduction in the Federal Automated Data Processing (ADP) standards development program of the Institute for Computer Sciences and Technology. The foregoing reductions that appear in the President's Budget have resulted from budget priorities formulated with particular concern for areas where the Federal Government may be undertaking efforts that are more properly the role of the private sector and State and local governments. The Board on Assessment appreciates the importance of avoiding activities in NBS that more properly belong elsewhere, but believes that the programs cited above lie well within areas where NBS is singularly competent.

The Board notes with deep concern, as in several recent years, the continuing reductions in staff contained in the President's FY 1985 Budget. I shall also address this matter in greater detail below.

Finally, the Assessment Panels are worried about certain constraints on research programs that are imposed on NBS. Because of the tight budgetary situation and the continuous reduction in staff positions over the past several years, NBS has had little flexibility to go into promising new areas of measurement. The Panels again wish to comment on the great difficulty that such reductions also cause to the high-priority, high-technology metrology programs at NBS. Metrology is the basic mission of the Bureau. Because of the great dependence of industry and commerce on metrology, adequate resources must be found to maintain the Bureau's unique role in this field.

Congress may decide, in recognition of the importance of certain high-priority areas, to impose floors on commitment to certain specified programs. Such restrictions, while helping to safeguard high-priority programs, can be counterproductive to the missions of NBS if funding of the programs is not provided concurrently. In circumstances of severe budgetary constraints, the management of NBS needs to maintain a significant degree of flexibility.

Center for Fire Research

The $5.141 million reduction in funding for the Center for Fire Research is a grievous loss to the public. This Center is carrying out extensive research with the purpose of getting scientific and technological information on fire hazards, combustion processes, the reduction of fire losses, and the protection of people.

Fires have always been tremendously damaging to life and property, and they remain so even in our highly technological society. Indeed, the United States incurs higher costs of fire, both absolutely and per capita, than any other industrialized nation in the world. Each year, about 8,000 people in this country die in fires and over 200,000 people are injured. Residential fires take the largest toll, but recent years have also seen catastrophic loss of life in public buildings such as hotels. The hazards are sufficiently recognized that codes for public structures are being tightened in many states and cities, but often in ways that have wide variance.

The private sector has indeed carried out some important research on fires, flammability, and detection. This work has, however, been specifically directed to special technologies such as new detectors, special communications methods to send alarms, and specific techniques for extinguishment. Product certification is handled by the Underwriters Laboratories. Research on fire protection of industrial buildings has been done by the Factory Mutual Research Corporation, for instance.

The NBS Center for Fire Research has been a prime contributor to the field of fire safety research. The programs have brought about the development of better understanding of basic fire phenomena and of means to reduce losses and the costs of fire protection. The expertise of the Center for Fire Research enables NBS to respond to special requests from other government agencies and the private sector on a reimbursable basis. The Center has developed test procedures for determining the flammability of fabrics and furnishings. Studies have been conducted on the characterization and movement of smoke. Other work is aimed at screening materials for the toxicity of their combustion products. The Center has also made excellent contributions to the use of computer modeling to study ignition and propagation of smouldering combustion.

It has been said that this sort of research and development should be left to the private sector and to State and local governments, on the premise that these bodies have economic and community incentives to improve fire safety. The Board on Assessment believes, on the contrary, that the Center for Fire Research performs a unique set of functions which are scientifically and technologically beyond the capabilities of existing private or public activities in the field of fire safety. The Board believes that this activity in NBS is highly cost effective for the national economy, and further that the programs provide inestimable protection to life and property. The Board on Assessment urges most strongly that funding be restored to the Center for Fire Research.

Center for Building Technology

The programs of this Center have unique value to consumers and the general public, and cannot and will not be done by industry. The building industry itself is fragmented into a great many separate technologies, most of which are highly specialized. Much of the work that the Center for Building Technology does is general in character and cuts across diverse fields. At the same time the Center maintains expertise in analysis and metrology closely coupled to the special needs of industry and of government at all levels.

The Center for Building Technology plays a singular role in removing technological market barriers and improving safety of building design and construction. It conducts field and laboratory research on the performance of building materials and structural systems. The research has greatly extended knowledge of: methods and instrumentation for the measurement of loads and of associated structural response; mathematical analyses for predicting time dependent effects of stresses of building structures; effects of earthquake-type loading on masonry; effects of temperature and time on strength gain of concrete; life of building materials. The Center has responded swiftly in the examination of major building and construction disasters. It has provided expertise and support to Federal agencies with building concerns, notably OSHA and GSA. It has also provided extensive nonproprietary information for the development of voluntary standards for buildings by extramural standards organizations.

The results of this research form an important and ever-increasing fund of information used to improve Federal, State, and local government codes and specifications. The industry and the public benefit through reduced cost of building, greater reliability and durability of buildings, and enhanced safety of construction. If these research programs were to be discontinued, the building industry would be incapable of developing a comparable broad and authoritative resource.

Reductions in Staff

Staffing reductions at NBS over the past several years have seriously reduced the effectiveness of many programs, severely restricted the Bureau's ability to move into important new areas, and from time to time were injurious to morale. The number of full-time equivalent positions fell from 3659 in FY 1980 to 3048 in FY 1983. Such a large reduction in force in so short a time has a tremendously adverse effect on any scientific organization, where the impetus is on the growth of knowledge. In the sciences of metrology the need for stability is particularly great, for it takes many years of experience to develop a staff member to the level of knowledge required for such exacting work. When large personnel cuts occur, the adverse effects on morale stimulate key people to leave for jobs elsewhere or to seek early retirement. Furthermore, such staff reductions have a serious dampening effect on the recruiting of young people. These young people are crucial to the future of the NBS program, for they bring to the Bureau the vigor of new ideas. Many form the continuum of expertise upon which the Bureau will depend in the future.

We recommend in the strongest terms that no further reductions in staff occur in FY 1985.

NEW PROGRAMMATIC INITIATIVES

The Board on Assessment enthusiastically supports the three major initiatives contained in the President's Budget: biotechnology, measurement service, and cold neutron facilities.

The proposed initiative in Biotechnology constitutes a timely introduction of the Bureau's intrinsic skills into one of the most active new areas of science and technology -- an area that is already plainly important to U.S. industry and commerce, and that is even now becoming highly competitive on the international scene. Biotechnology is already changing the chemical and allied industries. While the first major sector affected by biotechnology has been the pharmaceutical industry, other broad fields include agriculture and commodities. Over 250 U.S. companies are involved in the industrialization of biotechnology; included are nearly all the major chemical companies. This massive effort has brought about, in only a few years, a tremendous opportunity for U.S. commerce and industry. But at the same time it has generated acute needs for generic data bases, capabilities for industry-wide analytical procedures, and fundamental information on the measurement of materials important to biotechnology. The research contemplated by the Bureau in these new areas is an exciting extension of the institution's traditional role and responsibility.

The proposed initiative in Fundamental Physical Measurements and Standards addresses major national needs in industry and Government agencies. These needs are underscored by dramatic progress in scientific discovery, coupled with important technological advances. The intent is to strengthen greatly the measurement science base, including efforts on process and quality control; and to provide new standards, instrumentation, and measurement methods. The specific areas to be addressed are closely coupled to the newest high-technology fields. Among these are in electrical and electronic measurements and standards in measurement capability in radiation therapy in response to changing medical practices, and in new areas such as standards for high vacuum which are badly needed by a wide range of industries.

A third proposed initiative, the development of a facility for cold neutron research on materials, is a major step in providing the U.S. scientific and technological communities with new and greatly advanced capabilities to study the properties, performance, and processing of materials. Neutron research, but not with cold neutrons, is already applied at NBS and other U.S. facilities to the study of many materials. However, this country lags behind Western Europe in the use of high intensity cold neutron beams. No such facility now exists anywhere in the U.S., and only the Bureau's research reactor is well positioned to be extended competitively in the field of neutron research on materials and chemical processes.

OTHER FACILITIES

The NBS computing needs have been the subject of conern by the Assessment Panels for several years. The Panels have considered in detail the need for keeping the computational capabilities of NBS at the highest levels to be found, in both hardware and software. Basic to this concern is a large, central facility based on a modern computer of the most advanced design. The Assessment Board is glad to note that the President's Budget for FY 1985 includes this computational facility. The sharing of this activity by NBS and by the National Oceanic and Atmospheric Administration/Environmental Research Laboratories is an excellent plan. The Board on Assessment supports the prompt acquisition of this facility.

CONCLUDING REMARKS

The National Bureau of Standards performs a unique function on behalf of commerce and industry in the United States, and in support of this country's place in international trade. In many areas of science and technology, the Bureau is the primary source and repository of basic information. The preservation of its competences and the timely extension of its activities are exceedingly important to the Nation.

I fully recognize that the Subcommittee on Science, Research, and Technology is well aware of this importance, and I again express my thanks for the opportunity to testify.

WILLIAM P. SLICHTER

William P. Slichter is Executive Director, Research-Materials Science and Engineering Division at AT&T Bell Laboratories, Murray Hill, N.J. His responsibilities include fundamental studies in chemistry, metallurgy, and materials science, together with developmental and engineering activities in these fields that involve materials important to telecommunications.

Dr. Slichter joined Bell Laboratories in 1950, and initially engaged in research in physical chemistry of polymers. He was later involved in fundamental studies of growth of semiconductor crystals, and since 1953 has continued fundamental research on the structure and physical properties of polymers, with particular emphasis on nuclear magnetic resonance spectroscopy. He was appointed head of the Chemical Physics Research Department in 1958, and Chemical Director in 1967. He assumed his present post in 1973.

Born in Ithaca, New York, Dr. Slichter was raised in Cambridge, Massachusetts. He received his A.B. degree in chemistry from Harvard College in 1944, and his Ph.D. degree in chemical physics from Harvard University in 1950. He served in the U.S. Army, 1943-46.

He is responsible for major categories of materials used in communications, including a variety of plastics used for wire, cable and telephone apparatus; metals and alloys used in wire, magnetically operated devices, electrical contacts, and miniature circuits; ceramics and glasses; adhesives and paints; studies of corrosion; recycling of metals and plastics; and environmental quality.

In 1970 he was awarded the American Physical Society Prize in High Polymer Physics. In 1976 he was Charles Hurd Lecturer, Department of Chemistry, Northwestern University.

He is a member of the National Academy of Engineering, American Chemical Society, Society of the Sigma Xi; Fellow, American Physical Society, and the American Association for the Advancement of Science.

In addition, he is a member of the Editorial Board, *Science*, *Journal of Polymer Science*, *Advances in Polymer Science*; Board on Physics and Astronomy, National Research Council; Committee on Human Rights, National Academy of Science; Council, Gordon Research Conferences; Council, American Association for the Advancement of Science; National Materials Advisory Board, NRC; Chairman, Assessment Panels for the National Bureau of Standards. He has served in advisory capacities to the National Science Foundation, the National Aeronautics and Space Administration, and to several universities including Cornell, Harvard, Northwestern, and SUNY-Albany.

12/83

Mr. **Walgren**. Thank you very much, Dr. Slichter, and especially for focusing so directly on the areas of controversy. Your judgment is most valuable because you see this more closely than do Members of Congress, and it's important to have that kind of independent and technically expert impression of the value of these programs. I think your comments will find a lot of support among Members of Congress.

Would you comment just briefly on what you've seen in the way of staff morale in the reductions of force that we've experienced at the Bureau in the last several years?

Dr. **Slichter**. In the time frame, as I recall, of 1981-82, when there was a very substantial reduction in force amounting to over 400 people, it happened that the evaluation panel that I was responsible for met at the Bureau purely coincidentally then, and amongst people with whom I talked informally I would say people were quite blue. There has been a marked turnaround, and my current impression, and my colleagues on panels have agreed that this is so in our deliberations, is that the state of morale is very good, indeed. I'd be unable to say there's any other than episodic discontent. It's a bright and eager and dedicated bunch of people.

Mr. **Walgren**. I see.

Well, the Chair would recognize Mr. Brown.

Mr. **Brown**. Dr. Slichter, is it your impression that these proposed reductions stem mainly from the application of the administration's policy that research that can be done in some other area should be done by either the private sector or State and local government; that they've made that kind of a judgment in this situation?

Dr. **Slichter**. That's my conclusion, yes.

Mr. **Brown**. Do you know if they have done any backup studies? I know in the area of aeronautics, where we're considering a similar reduction, they actually made a fairly extensive study and came to the conclusion that they weren't correct in this and changed their mind. I'm wondering if you know of any similar studies that they may have made in these particular areas.

Dr. **Slichter**. I'm not aware of any such studies, Mr. Brown. The burden of my testimony, to reiterate, is that it's the conclusion of the panels, that the private sector and State and local governments are not equipped by personnel or facilities to carry out the exacting responsibilities of a high professional character that are carried out in these two Centers at the Bureau now.

Mr. **Brown**. As far as you know, there has been no questioning of the quality of the work in these areas that's proposed ——

Dr. **Slichter**. As far as I'm aware, there's been no questioning.

Mr. **Brown**. What is your general feeling about the problems of cost reimbursement for some of the services that the Bureau performs? Is that an area that you examined in your panels or is that outside your purview?

Dr. **Slichter**. We do examine it, but I would have to say at the outset our real purpose in the panels is to examine where we have prime competence, and we are technical people primarily, and in a short visit to the Bureau we spend nearly our full time looking at the actual projects and talking to the people who are involved technically.

As users and as workers in universities and industry, we're aware that it's important to have a continuing competence if you want to stay up with the field.

I listen to discussions in panel and conclude that, from the viewpoint of a research manager, I'd expect to pay for costs and shipment of things that I make use of, but maintenance of a continuing competence is something that I regard as not an episodic matter to be reimbursed ad hoc, but rather something that ought to be there.

Mr. **Brown**. This next question may be outside your area of expertise or you may not even be interested in answering it. But last year there was, in connection with legislation to reorganize the Department of Commerce into a Department of Trade, there were some proposals for moving the Bureau into some other organizational conformation, and a number of such suggested changes have surfaced.

Have you had occasion to review the possibility that there might be some better locale for the Bureau, organizationally speaking, than its present situation in the Department of Commerce?

Dr. **Slichter**. The timing of the meetings of the evaluation panels has been such that that hasn't even come before us. We last met before that proposal was made, and we have not together been presented with any of the information. I am aware, however, that the statutory visiting committee has discussed this in some measure.

Mr. **Brown**. Perhaps we should try to get their opinion on the matter, then.

One other question, and again this may be outside the area that you have any familiarity with, but in some recent meetings with researchers in the seismic area, earthquake hazard mitigation people, there was some discussion of the need for a large shake table type of equipment in the Bureau, similar to what the Japanese have, for evaluating structural conditions as a result of seismic shaking.

Are you in a position, or have you had any conversations with regard to that suggestion, or do you have any comments that you might like to offer on that?

Dr. **Slichter**. Frankly, I have not heard about the suggestion, Mr. Brown.

Speaking only for myself, I think that, upon advice of a user community, including competence in a Government laboratory such as the Bureau, that might well represent a path of progress that would be very useful, but it would then have to fit into some scheme of priorities.

Mr. **Brown**. In your opinion, it should not be undertaken—well, it should go through a normal process of analysis by a user community and prioritizing in normal channels within the agency, and so on?

Dr. **Slichter**. To the best of my belief, yes.

Mr. **Brown**. Yes. All right. I didn't want to belabor that. I should have asked the Bureau people about it, but I forgot to.

I have no further questions.

Mr. **Walgren**. Thank you, Mr. Brown.

We appreciate your testimony, Dr. Slichter; very much.

Dr. **Slichter**. Thank you.

Mr. **Walgren**. The last witness today is George Meixel, who is the board chairman of the American National Metric Council; accompanied by the President of the Council, Albert Navas.

Gentlemen, if you would come forward. We want to keep metric questions in front of us, and there's no more appropriate place than a discussion of what efforts we're making through the Bureau of Standards to enhance measurement capabilities and measurement usage in our country. We're very pleased that you could come and join us today and give us some view of where we are with the metric measurement in our economy and what steps seem to you to make immediate sense.

Mr. Meixel.

STATEMENT OF GEORGE D. MEIXEL, BOARD CHAIRMAN, AMERICAN NATIONAL METRIC COUNCIL, BETHESDA, MD, ACCOMPANIED BY ALBERT M. NAVAS, PRESIDENT

Mr. **Meixel**. Thank you, Mr. Chairman.

As you mentioned, I am board chairman of the American National Metric Council, and with me is Al Navas, our president.

And we are very pleased to be here this morning to speak to you on the issue of U.S. metric transition. ANMC is the major private sector focal point for metric issues, representing a membership base of large and small businesses, trade associations, and professional societies, educators, consumers, and government agencies. We have a membership which is about 11 percent of the Fortune 500 and some 44 percent of the leading U.S. exporters.

We spoke to this committee last in March 1983 on the necessary role of the public and private sectors in the U.S. transition process and the need for cooperative government and private efforts in the metric area. We come before you today to support the Metric Evaluation Act of 1984, which is known as H.R. 4490.

There has been no major congressional activity on the metric issue since the passage of the Metric Conversion Act of 1975. Since that time, much has happened regarding metric transition that warrants the need for H.R. 4490 and an independent evaluation of the impact of metric conversion on the United States.

In 1982 the U.S. Metric Board was phased out of operation as part of the Administration's program to reduce Government spending. The Federal responsibility for metric activity was then given to the U.S. Department of Commerce. These actions were viewed by the media and the general public as a lack of interest in metric use by the Government.

However, President Reagan has stated, "* * * the issue of metric transition has become increasingly important in the area of international trade and productivity."

And, Secretary of Commerce Baldrige has said, "Use of the metric system is important in improving our international trade position."

The National Productivity Advisory Committee has even recommended, "* * * the Federal Government continue to support conversion to a system of metric measurement as a means of enhancing U.S. international competitiveness and hence productivity in several industries."

Many U.S. industries already are using metric measures in their activities, from computer manufacturers, to soft drink and liquor producers, to automobiles and heavy farm equipment makers. Sales losses have been documented in the lumber, machine tools, and produce industries due to inabilities to deal and trade in metric. On the other side, companies like General Motors, Deere, Du Pont, Caterpillar, and IBM have documented cost savings in the hundreds of thousands of dollars associated with using metric.

As the Metric Evaluation Act of 1984 so succinctly states, "There is a need to objectively evaluate the data bearing on conversion to the SI metric standard of measurement in the United States."

We said to this committee on March 23, 1983: "ANMC is concerned that the issues of metric transition have languished unaddressed too long. We urge the Congress to consider taking appropriate actions to clarify our Nation's metric policy and goals and to work with the private sector toward ending the seemingly endless debate. Sitting on the metric fence indefinitely is unproductive and costly."

H.R. 4490 should be enacted. We support its passage, and we urge you to move ahead with this bill. We offer you our help and assistance in all phases of this vitally important activity.

And we want to thank you for the chance to speak again today in support of the act. Mr. Navas and I will answer any questions you may have that we are capable of doing.

[The prepared statement of Mr. Meixel follows:]

Remarks by

George D. Meixel
Chairman, Board of Directors
American National Metric Council

at

U. S. House of Representatives
Subcommittee on Science, Research, and Technology

Hearings on the
National Bureau of Standards and Related Agencies

February 2, 1984

Good Morning. My name is George Meixel and I am the Chairman of the American National Metric Council Board of Directors. With me today is Mr. Albert Navas, the President of the Council.

We are pleased to be here this morning to speak to you on the issue of U.S. metric transition. ANMC is the major private sector focal point for metric issues, representing a membership base of large and small businesses, trade associations and professional societies, educators, consumers, and government agencies. (This membership is 11% of the Fortune 500 and 44% of the leading 50 exporters.)

We spoke to this committee last in March 1983 on the necessary roles of the public and private sectors in the U.S. transition process and the need for cooperative government and private efforts in the metric area. We come before you today to support the Metric Evaluation Act of 1984 (H.R. 4490).

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As the Metric Evaluation Act of 1984 so succinctly states "there is a need to objectively evaluate the data bearing on conversion to the SI metric standard of measurement in the United States." We said to this committee on March 23, 1983: "ANMC is concerned that the issues of metric transition has languished unaddressed too long. We urge the Congress to consider taking appropriate actions to clarify our nation's metric policy and goals and to work with the private sector towards ending the seemingly endless debate. Sitting on the metric fence indefinitely is unproductive and costly."

H.R. 4490 should be enacted. We support its passage and we urge you to move ahead with this bill. We offer you our help and assistance in all phases of this vitally important activity.

Thank you for the opportunity to speak to you today in support of the Metric Evaluation Act of 1984. Mr. Navas and I would be pleased to answer any questions.

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GEORGE D. MEIXEL

CHAIRMAN

AMERICAN NATIONAL METRIC COUNCIL

Mr. Meixel has been with Ingersoll-Rand since 1941. After wartime service with the U.S. Army, in which he rose to the rank of major, he rejoined the company and held responsible sales positions in Cleveland and Boston. He held positions in sales training and salary administration before being named as manager of the Phillipsburg, New Jersey, and West Easton, Pennsylvania, plants. He has also served as corporate manager of salary administration.

He became Chairman of the American National Metric Council in February 1982.

He holds a B.S. degree in mechanical engineering from the University of Nebraska.

He retired from Ingersoll-Rand in November 1983. He is currently a consultant for the firm.

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ALBERT M. NAVAS

President & Chief Executive Officer

American National Metric Council

Mr. Navas was born in Fort Benning, Georgia in 1929 and graduated from The Virginia Military Institute with a BA in history in 1952. He received his Masters Degree in Business Administration from The Indiana University School of Business in 1965.

Mr. Navas served on continuous active duty with the United States Air Force as a pilot and subsequently Wing Commander from November 1952 until his retirement in June 1979. He joined Arthur Andersen and Co. in August 1979 as Audit Division Administrator and Assistant Recruiting Coordinator until joining ANMC in August 1983 as President and Chief Executive Officer.

Mr. Navas resides in McLean, Virginia with his wife Barbara Hunt Navas. They have three daughters and one son. The Navases attend St. John's Episcopal Church in McLean and are active in church and community affairs.

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Mr. **Walgren**. Thank you very much, Mr. Meixel.

The Chair would like to recognize the gentleman from California, in view of his continuing interest in this question.

Mr. **Brown**. Thank you, Mr. Chairman.

Mr. Meixel, how would you characterize the role and activity of the Department of Commerce with regard to metric conversion at the present time?

Mr. **Meixel**. Well, I would say they are doing everything they can within their limited budget to help it. They are not exactly taking a lead role. They're saying that the private sector is to do that, and we're endeavoring to do that. But, as we have said before, it's a partnership, and we think they need a little more help over there.

Mr. **Brown**. How much—I don't have the figures here in front of me, but do you happen to know how much staff and dollars they have to spend on this?

Mr. **Navas**. Their budget is approximately $300,000 and they have a staff of five people.

Mr. **Brown**. And, basically, what does the staff—what are the activities they engage in?

Mr. **Navas**. They're mostly similar to ours, information on metric transition from the public side of the house. As Mr. Meixel stated, we represent the private sector.

Mr. **Meixel**. They also are looking at getting rid of the barriers that might inhibit transition. There are certain legal ones, particularly in the States. They're doing what they can to identify those. They ask for our cooperation.

They also chair an interagency committee of the various Government agencies that tend to have to cooperate.

Mr. **Brown**. You have indicated that a degree of confusion seems to exist amongst the business community and others with regard to where we're actually going in metric. Do you have any indicators that would show the degree to which any change is taking place at this time, whether it's slowing down or speeding up or remaining stable, or what the situation is?

Mr. **Meixel**. We monitor press notices monthly. We have a service that does that for us. I would say that the impression we have is that metric is proceeding but rather slowly. It had a lot of impetus about 5 years ago, and then the—a combination of things, one being the GAO study of 1978, which seemed to have quite a bit of negative stuff in it. Actually, the study wasn't so negative, but the executive summary was more negative, and the paragraph headings of the executive summary were most negative. But if you read the whole study, it was sort of balanced.

Mr. **Brown**. Yes.

Mr. **Meixel**. But the press picked that up.

And the other thing I would say was the signal that was given when the Metric Board was not funded. That just said, well, it isn't happening.

So the public's perception is that we've cooled, and we're really asking for a clarification. What does the Government want us to do?

Mr. **Brown**. And the purpose of the legislation would be, in effect, to review the whole situation and come out with a policy recommendation that would get us off dead center on this?

Mr. **Meixel**. That would be part of it.

We participated, our firm, with Ingersolrad in a study that was done under Government sponsorship a few years ago on the efficiency of electric motors and pumps and to see whether the industry was coping with this properly. It was in the Energy Act of 1978, and it was done by an outside firm. And we were impressed that this group could get information that other people couldn't.

Today most of the things that are done are opinion surveys. You try to tell somebody, "Well, show me exactly where we are."

When we've been out to try to solicit new members with major firms, they say to us, "Prove to me that if I go metric it will help me," or, even more reverse, "What would happen if I don't go?"

We have scattered cases, and the big story is General Motors, but they say, "Don't tell me that story again. Give us some other thing."

Mr. **Brown**. So the best way to approach that would actually be to have a contractor do an in-depth analysis that would give us the information that would be useful here?

Mr. **Meixel**. Yes, sir, Mr. Brown. I think that a qualified contractor with a protocol that had been drafted in advance, and probably hearings held on it, so you'd debug it before you did it, and one that could also look at the international aspects of this—it wouldn't work just in the United States; you'd have to find out what is the European community doing. It's been suggested in the bill certain areas that make some sense.

Mr. **Brown**. If this committee in its wisdom should decide to include the mandate contained in the bill in other legislation that we're moving ahead, such as the Bureau of Standards legislation, do you see any adverse effects from moving it in that fashion, which would probably get it acted on a little quicker?

Mr. **Meixel**. No, sir.

Mr. **Navas**. Not at all. It's a measurement sensitive standard, the bill is, related to measurement, and we feel it should properly fall in that category.

Mr. **Brown**. In the Bureau of Standards authorizing legislation?

Mr. **Navas**. Yes, sir.

Mr. **Brown**. Fine. I have no further questions.

Mr. **Walgren**. Thank you, Mr. Brown.

The Chair would recognize counsel for the minority.

Ms. **Bach**. Thank you, Mr. Chairman.

Just one quick question: I'm interested whether or not anyone in the American National Metric Council has had the opportunity to discuss this whole topic with Dr. Bruce Merrifield of OPTI, which is the Office of Productivity, Technology, and Innovation.

Mr. **Meixel**. We have in very brief fashion, and we intend to give it to him in more detail.

Ms. **Bach**. I would just make a suggestion to the subcommittee that perhaps next week when we do have Dr. Merrifield here, that we might be able to take the opportunity to ask this question.

Mr. **Meixel**. We would like to say that the cooperation from Commerce, with their limited group, has been outstanding with us.

We have no problems at all trying to work with them, but they are limited in what they can do.

Mr. WALGREN. Obviously, this is a balancing act within the administration in how to go forward. I would like to enter into the record the letter from President Reagan to the National Metric Council, dated April 11, 1983, which confirms the importance that the President himself puts on the contribution that metric measurements will make to a strong American economy.

Mr. BROWN. I give you my unanimous consent to do that. [Laughter.]

[Letter from President Reagan to the American National Metric Council follows:]

THE WHITE HOUSE
WASHINGTON

April 11, 1983

I am pleased to greet members of the American National Metric Council at your Ninth Annual Conference.

This is the first year the Secretary of Commerce has had the lead Federal responsibility for support of industry's transition to metric measurement. It is gratifying to know that the Department of Commerce is the co-sponsor of the 1983 ANMC Conference.

In the past year, the issue of metric transition has become increasingly important in the area of international trade and productivity. The National Productivity Advisory Committee has recommended that the Federal Government continue to support conversion to metric measurement to enhance U.S. international competitiveness and hence productivity in several industries.

With full cooperation between the public and private sectors, I am confident we can achieve this important goal.

You have my best wishes for a productive and successful meeting.

Ronald Reagan

Mr. **Walgren**. Well, we appreciate very much your coming before the committee, and we look forward to working with you on this problem.

Mr. **Meixel**. Thank you, sir.

Mr. **Walgren**. That concludes the hearing for today. Thank you very much.

[Whereupon, at 12:15 p.m., the subcommittee recessed, to reconvene at the call of the Chair.]

1985 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

TUESDAY, FEBRUARY 7, 1984

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:35 a.m., in room 2325, Rayburn House Office Building, Hon. Doug Walgren (chairman of the subcommittee) presiding.

Members present: Walgren, MacKay, Valentine, Gregg, Boehlert, Sensenbrenner, McGrath, and Skeen.

Mr. **Walgren**. Let me welcome you all to the second day of hearings on the fiscal year 1985 budget for the National Bureau of Standards, and the two related organizations, the Office of Productivity, Technology, and Innovation, and the National Technical Information Service. The subcommittee will also look at the status of programs within the Earthquake Hazards Reduction Act in addition to other functions of these offices and the Federal Fire Prevention and Control Act.

We have specific concerns about the proposed elimination of the Center for Fire Research, Center for Building Technology, and the severe reduction in support for the Institute for Computer Sciences and Technology. The subcommittee must examine the administration's fiscal year 1985 budget proposals in terms of their broader impact on, not only the Bureau, but on the U.S. research and development effort as a whole.

I would like at this point to recognize Mr. Gregg for any opening comments or introductions that he may want to make.

Mr. Gregg.

Mr. **Gregg**. I appreciate that, Mr. Chairman. I have no formal introductory comments. I would like to welcome the witnesses, especially Professor Stockmayer from Dartmouth, who lives in Vermont, unfortunately. Obviously he should get a good reception at this committee because he went to a good school which produces many chairmen of subcommittees of the House it seems, and he is teaching in a great district.

Mr. **Walgren**. As they say, it is a small college, but there are those of us who love it. What did they say, New Hampshire is the only State that has only one thing of everything?

Mr. GREGG. That is probably true, but we do have six or seven Presidential candidates.

Mr. WALGREN. We appreciate the witnesses coming before the committee today. We really do rely on you for your particular perspectives and your judgment. I would like to start with Dr. Bruce Merrifield, the Assistant Secretary for Productivity, Technology and Innovation in the Department of Commerce, and then proceed with Dr. Joseph Caponio, the director of the National Technical Information Service, also from the Department of Commerce.

Gentlemen, we are grateful for you coming before the committee. Your written testimony and anything further in writing that you would like to submit for the record would be most welcome. It will be made part of the record as a matter of course. Please proceed to highlight what you feel is most important in the most effective way as you would like.

Dr. Merrifield.

STATEMENTS OF DR. D. BRUCE MERRIFIELD, ASSISTANT SECRETARY FOR PRODUCTIVITY, TECHNOLOGY AND INNOVATION, DEPARTMENT OF COMMERCE; AND DR. JOSEPH E. CAPONIO, DIRECTOR, NATIONAL TECHNICAL INFORMATION SERVICE, DEPARTMENT OF COMMERCE

Dr. MERRIFIELD. Mr. Chairman and members of the subcommittee, I am pleased to have this opportunity to discuss the authorization for the programs of the Office of Productivity, Technology and Innovation. The Secretary of Commerce will be submitting draft legislation which would, if enacted, authorize appropriations for the National Bureau of Standards and the Office of Productivity, Technology and Innovation.

Dr. Ernest Ambler, Director of NBS, appeared before you on February 2 to describe the activities of NBS.

As Assistant Secretary for Productivity, Technology and Innovation, I serve as the principal adviser to the Secretary of Commerce on issues of productivity and technological innovation and competitiveness. The two organizations that report to me are the Office of Productivity, Technology and Innovation [OPTI] and the National Technical Information Service [NTIS]. Today I will confine my testimony to OPTI, which is covered in section 4 of the proposed bill and for which we have requested $3,371,000 in fiscal year 1985 appropriations. Dr. Joseph Caponio, the Director of NTIS, will testify on NTIS.

I request that my written testimony appear in the record as submitted and I will summarize my thoughts briefly.

Mr. WALGREN. Please proceed.

Dr. MERRIFIELD. It is my belief that technology will progressively be the driving force of the United States and world economies over this and succeeding decades. The explosion of information in the sciences will continuously obsolete products and processes long before their useful lives can be realized and telescope life cycles. Life cycles in electronics are 3 to 5 years now, and in other areas 5 to 10 years.

I think it is very important that we recognize that the United States has major advantages over every other nation. We have the most advanced technology in the world. We put many times more money into the fundamental pool of knowledge than any other nation. We have an entrepreneurial culture that is unique, takes risks, and does things that other nations cannot seem to do. We have an unparalleled industrial infrastructure that has the ability to translate useful technology into new products and processes. We have the best capital formation capability, the world's largest contiguous market, a common language. At the same time it is essential that we mobilize these tremendous resources effectively, and that is not an easy thing to do.

We have many barriers to innovation; particularly I have been focusing on the antitrust barriers which prevent our companies from collaborating on a scale that can be competitive in world markets where other nations are targeting our businesses.

The cost of capital is significantly higher here in the United States than in any other country, particularly as related to some of our major competitors. Innovation is particularly sensitive to the cost of capital.

Our objectives are to mount proactive but catalytic efforts which will remove barriers and help to mobilize these resources effectively.

The OPTI program has focused heavily on limited R&D partnerships as one mechanism for funding new developments. We developed a series of guidelines for companies to undertake this sort of thing. We have held many informal briefings with groups of companies and we have developed an intern program where we bring people into our offices and teach them how to do computer simulation. In the NTIS, which Dr. Caponio will talk about, one of our major programs is the licensing of Government-owned technology into the private sector, a critical need that has not had much previous success.

A major focus of our effort is in the intellectual property area. It is important that we transfer the patent rights to our Government technology back into the private sector. As you know, we have a Presidential memorandum directing agencies to do that, and we now have the Federal acquisition regulations prepared and hopefully they will be issued by the 1st of April. I chair an Interagency Committee on Intellectual Property, and one of the objectives of this committee is to strengthen intellectual property rights. The Dole bill would modify those agency charters that now prevent them from granting back licenses for patents and technology to contractors, and I think a similar bill in the House is being prepared.

In addition our staff supports the Presidential Commission on Industrial Competitiveness, and supported the White House Conference on Productivity. Also, we have a major effort in metrification. It is my belief that we are in world markets; every business is involved in a world market now. But the United States is one of only three nations in the world that does not use metric measures and weights. Metrification is essential for competitiveness in world markets. And it is one of our major intents to try to accomplish that.

We have mounted a small-business development capability where the R&D limited partnership has particular potential, but the levels of experience and capabilities of small business are limited, and that is where we can hopefully make a significant contribution.

One other thing that I think is very important to us. We have a major opportunity now for the first time since the invention of the printing press to increase both the productivity and the quality of education in our school systems and to facilitate the continuous reskilling of the work force; this is an urgent need. It will involve the use of the videodisk technology with computer-interactive terminals. The initial data from these studies indicate that at least 100 percent greater rate and quality of learning can be achieved in the school systems. This is a powerful technique, I think it has to be one of our top priorities to avail ourselves of this technology now and begin to considerably improve both the quality and the productivity of our educational systems.

In conclusion, let me emphasize again the critical role of technology in the world today, and the urgent need to mobilize our incomparable resources for innovation here in the United States. The greatest leverage I think will come from removal of barriers to innovation such as the antitrust laws, the provision of better tax incentives, and the reduction of the cost to capital. I think it is important that we facilitate these objectives as best we can, and that is what we see as our mission.

Thank you, and I would be happy to answer any questions.

[The prepared statement of Dr. Merrifield follows:]

U.S. DEPARTMENT OF COMMERCE
STATEMENT OF D. BRUCE MERRIFIELD
ASSISTANT SECRETARY FOR PRODUCTIVITY, TECHNOLOGY AND INNOVATION
BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

FEBRUARY 7, 1984

Mr. Chairman and Members of the Subcommittee, I am pleased to have this opportunity to discuss the authorization for the programs of the Office of Productivity, Technology and Innovation. The Secretary of Commerce will be submitting draft legislation which would, if enacted, authorize appropriations for the National Bureau of Standards and the Office of Productivity, Technology and Innovation. Dr. Ernest Ambler, Director of NBS, appeared before you on February 2 to describe the activities and programs of NBS.

As Assistant Secretary for Productivity, Technology and Innovation, I serve as the principal advisor to the Secretary of Commerce on issues of productivity and technological innovation and competitiveness. The two organizations that report to me are the Office of Productivity, Technology and Innovation (OPTI) and the National Technical Information Service (NTIS). Today I will confine my testimony to OPTI, which is covered in Section 4 of the proposed bill and for which we have requested $3,371,000 in FY 1985 appropriations. Dr. Joseph Caponio, the Director of NTIS, will testify on NTIS.

We are all aware that advancing technology is one of the major driving forces for both the U.S. and the world economy. It is progressively shortening the life cycle of products and processes; it is substituting new systems for old; it is placing increased competitive pressure on some of our industries; but it is also opening up unparalleled new opportunities.

I think we need to remind ourselves that this nation funds several times more basic research than does any other country, and that therefore we have an enormous pool of advanced technology upon which to draw. We also have an incomparable depth and breadth of industrial infrastructure that can translate basic discoveries into useful products, processes and services. In addition, we have a unique entrepreneurial culture, the most flexible capital development capability, and the world's largest market. In my mind, there is no question that we have unparalleled advantages over all other nations if we can effectively mobilize these resources.

I see this mobilization task as our mission. Our approach is to remove barriers, provide incentives, and stimulate industrial innovation and productivity enhancement in the private sector through non-interventionist methods. Our aim is to create a climate conducive to innovation and productivity growth.

I'd now like to discuss briefly the OPTI programs.

The Industrial Technology Partnership (ITP) program was initiated in 1983. It is designed to stimulate higher levels of private sector R&D investment in the United States. The primary focus is on greater use of R&D limited partnerships (RDLPs). By attracting funds from limited partner investors, companies using the RDLP approach can undertake R&D projects which normally would be too large for any single company to mount -- all without the federal government's direct involvement. The advantages are many: the equal availability of RDLPs to growing, troubled or start-up businesses; the ability of RDLPs to capitalize on existing tax incentives; and the use of previously untapped venture capital rather than retained earnings, new equity issues or borrowing. Examples of OPTI efforts to promote private sector use of RDLP's are:

- publication of guidelines on forming RDLP's, over 2,000 of which have been distributed following requests;
- preparation of feasibility packages to identify high technology projects suitable for large scale RDLP's;
- working toward the clarification of IRS rules as they apply to RDLP's;

- the performance of computer simulations of industry sensitivity to key variables such as labor, materials, and quantity of production, thereby identifying actions most conducive for the application of RDLP's;

- implementation of four regional conferences and other outreach activities to publicize the advantages and concept of RDLP's;

- educating private sector individuals in understanding the use of RDLP's, and;

- the development of tax proposals to strengthen incentives for RDLP formation.

By my estimate, RDLP's provided over $500 million for new technological projects in 1983 alone. A growing number of RDLP's are forming in the over $25 million range.

The Office of Productivity, Technology and Innovation is also participating in a working group formed by the Cabinet Council on Economic Affairs (CCEA) to modify tax laws to improve incentives for developing the high risk, long term advanced technology that is needed to maintain U.S. industrial leadership. At our urging, the Cabinet Council on Economic Affairs recommended that the 25 percent incremental R&D tax credit be extended for three years.

In addition, OPTI contributed to the drafting of the Administration's proposed legislation -- the "National Productivity and Innovation Act of 1983" -- which would ease antitrust constraints on cooperative R&D.

The Government is spending over $40 billion a year to fund research and development. This R&D is either performed by private sector performers under contract or federal employees in the course of their employment. There is a continuing stream of new technology from this effort, some of which can be the basis for new products, services, jobs and industries. Through the Federal patent policy program OPTI is moving vigorously to remove any identified barriers and create the necessary incentives for the commercialization of this technology.

Examples of activities under the Federal patent policy program are:

- establishment of an Interagency Committee on Intellectual Property for Innovation, which I chair;

- issuance, at OPTI's initiative, of a Presidential Memorandum extending contractor ownership of inventions to all contractors, within certain statutory limitations. We have worked with private sector organizations and Congressional offices to draft legislation in this area such as S. 2171 introduced on November 18, 1983 by Senator Dole;

- development of a model system for Federal laboratory cooperation with the private sector designed to increase the flow of Federal technology into new products and processes through increased management focus and enhanced incentives for inventors and the laboratories in which they work;
- expected issuance of a new Federal Acquisition Regulation to implement the new Federal patent policy; and
- review of agency implementation of P.L. 96-517 (Patent and Trademark Amendments Act of 1980).

We are increasing our efforts to license commercially valuable inventions owned by the government through the NTIS Patent Licensing Program. Dr. Caponio will discuss this in more detail. The Center for the Utilization of Federal Technology (CUFT) implements provisions of Section 11 of the Stevenson-Wydler Technology Innovation Act of 1980. This program alerts industry to that Federal technology with the highest potential for practical commercial use. Dr. Caponio will also address this program in his testimony.

In our productivity policy and coordination program, we

- provided policy initiatives and analytic support to the Cabinet Councils on Economic Affairs and Commerce and Trade, the National Productivity Advisory Committee, and the President's Commission on Industrial Competitiveness;
- prepared issue papers for the White House Conference on Productivity, conducted a symposium with the Department of Labor to apprise State Cabinet level officials of Federal resources to help promote local firms' productivity, and organized a conference with the managing directors of the European Association of National Productivity Centers, to exchange know-how on latest industrialized nation productivity practices;
- established a pilot program to improve productivity measurement at the firm level, while concurrently providing a methodology for interfirm productivity performance comparisons; and
- developed a system for synthesizing policy recommendations from major private sector and public forums.

Another productivity-related program is operated by our Commerce Productivity Center. The Center:

- o answers (annually) about 3,000 inquiries for productivity 'know-how' information -- mostly with off-the-shelf publications, and
- o furnished leadership in a current National Productivity Awareness Campaign in partnership with the American Productivity Center, the Advertising Council and the National Association of Broadcasters.

One of the factors that affects our ability to compete abroad is whether we supply products in metric sizes. The United States is the only industrialized country which is not predominantly metric. Examples of our activities in the voluntary metric conversion area are:

- o providing the public with general and technical information on the metric system and the conversion process -- we answer thousands of inquiries per year;
- o operating interagency metric committees to foster a more uniform approach to Federal metric usage. The recent decision to include metric measurements in federal civilian standards and specifications stemmed from this activity;

- identifying Federal regulations which impede increased metric usage by the private sector and seeking their modification or removal, and

- providing staff services to the National Conference on State Metrication and the Metric Education Information Committee;

Shifting to another area, smaller firms are major developers of new, technology-based products and services. Yet, it is often difficult for them to complete all the steps along the innovation pipeline because they lack information on essential services such as financing, licensing opportunities, and Federal Government and private sector support programs. Accordingly, OPTI is identifying the existing sources of information and services to support small business innovation, and will make that information available in a format that can be used easily by our small, technology-based business community.

Mr. Chairman, the absolutely critical role that productivity growth and technological innovation plays for U.S. economic growth and international competitiveness cannot be overemphasized. I believe that OPTI is making a significant contribution in this regard.

I would be pleased to answer any questions.

BIOGRAPHICAL DATA

D. BRUCE MERRIFIELD

Dr. D. Bruce Merrifield is a graduate of Princeton University and holds Masters and Doctoral degrees in Physical Organic Chemistry from the University of Chicago.

Dr. Merrifield has since been in research, research administration and new venture management and is currently Assistant Secretary of Commerce for Productivity, Technology and Innovation. Formerly, he was Vice President of Technology and Venture Management for The Continental Group.

He is a former Director and president-elect of The Industrial Research Institute; he also has been Chairman of the Board of The IRI Research Corporation and is a former Trustee and Chairman of the Research Council of The American Management Association. Currently, he is a member of The Directors of Industrial Research, a member of Sigma XI Honorary Society, and is a Fellow of both The American Association for Advancement of Science and of The Institute of Chemists.

Dr. Merrifield also has been a member of the Advisory Board for the Binational Research and Development Foundation with Israel and of the U.S. Department of Commerce's Trade Mission to the People's Republic of China. He has served both as Science Advisor to the Jordanian government and as a member of one of the Department of Defense transition teams.

Dr. Merrifield also has been active in community affairs as a former Chairman of the Board of Education, a Trustee of several schools, as National Chairman of the Princeton Alumni Association, a board member of several foundations, and a member of the Executive Council of the Episcopal Church.

Mr. **Walgren**. Thank you, Dr. Merrifield.

Let me turn to Mr. Gregg for some initial questions in view of time constraints in his schedule.

Mr. **Gregg**. Doctor, I unfortunately have to leave in a few minutes. Can you expand a little bit on this videodisk concept in layman's terms?

Dr. **Merrifield**. Yes. IBM has for example just completed or is completing a 10,000-person study of reading in early grades. They have not released the study, but I understand that it has demonstrated very significant increases in both the quality and the rate of learning. More than that it is color-blind. The blacks do just as well as the whites, as you might expect. A sort of devastating comment of one black boy was in answer to the question, Why do you like the computer so much? "Well, it don't scream at me," which is a sad commentary on the level of education in our school systems.

I think that the early evidence is that it is a powerful tool. We cannot afford not to use it, to escalate the content of the curriculum to the leading edge of our knowledge base, to use the simulation techniques of the videodisk, which are very exciting and very stimulating and turn people on to education instead of off.

I think it is equally important in terms of continuous reskilling of the work force. The estimates are that there will be half a million to a million people per year forever being thrown into the work force as we obsolete older products and processes, and this continuous reskilling is going to be a critical need of our society. Again, this is an available technique that could facilitate that. I think again it is technology whose time has come. I would hope that we can coalesce a lot of the fragmented forces that are now active here. There are a lot of activities going on all over the United States. Many of them subcritical in skills and confidence, if we can coalesce those I think we can make progress. Our present efforts are to inventory those efforts and try to identify what those critical mass consortia might be, perhaps funding through R&D limited partnerships to some degree.

Mr. **Gregg**. Thank you.

Mr. **Walgren**. With that, let us turn to Dr. Caponio, and we will go through his testimony and then come back if it is acceptable.

Dr. **Caponio**. With your permission, Mr. Chairman, I would like to read a very brief statement.

Mr. Chairman and members of the subcommittee, I am pleased to be here to discuss the activities of the National Technical Information Service.

The NTIS enabling legislation which was passed in 1950 directs the Secretary of Commerce to establish and maintain within the Department of Commerce a clearinghouse for the collection and dissemination of scientific, technical, and engineering information. Section 3 of the act requires that costs of the clearinghouse be paid from sales income, not from tax-supported congressional appropriations. In 1970, NTIS was established as a primary operating unit of the Department to serve as that clearinghouse. NTIS makes Federal technological, scientific, economic, and engineering information accessible to business, industry, Government, and other interested individuals and organizations. Use of the technological information that NTIS disseminates serves to: One, improve the economic health and growth of U.S. business and industry; two, increase productivity and innovation in the United States; three, improve the competitive position of U.S. firms in the world marketplace; and four, promote the use of foreign research results by U.S. industry.

NTIS serves as the primary source for the public sale of Government-sponsored research and engineering reports, reports on federally sponsored research in progress, machine-processed data files, and computer programs. As this central source, NTIS provides a full array of information products and services designed to encourage wider use of technology.

In fiscal year 1983 NTIS acquired and made available approximately 80,000—including 18,000 foreign—new Government-sponsored research and engineering reports. Our costs of providing these information products and services were in excess of $25 million and were fully recovered by revenue from the sales. Approximately 500,000—including 25,000 foreign—copies of documents were sold in paper form and 2,600,000 in microfiche.

Mr. Chairman, the NTIS clearinghouse operations are 100-percent self-supporting. However, there are two current, non-clearinghouse programs within NTIS which have received appropriated funds through the Office of Assistant Secretary for Productivity, Technology and Innovation. These programs are the patent licensing program and the Center for the Utilization of Federal Technology.

Our patent licensing program is the Government's most active patent licensing program in terms of numbers of licenses and royalties received. We evaluate new technology developed within Federal laboratories to identify inventions with possible commercial potential and promote selected inventions to U.S. industry. Our foreign filing activity involves the protection of U.S. Government owned technology from unrestricted, uncompensated use by foreign competitors of U.S. industry. In fiscal year 1983 the program successfully: Negotiated 41 patent licenses including 14 exclusive licenses. Received royalties of $907,000—these licensing royalties incidentally are returned to the U.S. Treasury. Paid cash incentive awards to 63 employee inventors. The 41 new licenses are expected to result in private investment by the licensees of some $92 million, to bring these inventions into commercial use. Appropriated funding for the program was $502,000 in fiscal year 1984, and $910,000 is requested for fiscal year 1985. The requested increase—$365,000 over the base amount of $545,000—would reduce the backlog of licensing inquiries from U.S. companies, permit additional foreign filing of selected inventions, and permit promotion of more licensing opportunities.

The activities of the Center for the Utilization of Federal Technology, known as CUFT, implement the provisions of section 11 of the Stevenson-Wydler Technology Innovation Act of 1980. This program alerts industry to selected Federal technology with the highest potential for practical commercial use. The program serves as a catalyst to assist and encourage agencies to evaluate and selectively highlight their technology. Appropriated funding for the program was $495,000 in fiscal year 1984. No appropriations are being requested for fiscal year 1985 because the program will be self-supporting, funded by revenues generated by the sale of products and services developed in the startup stage of the program. New products developed in fiscal year 1983 and fiscal year 1984 include the following: an annual catalog of Federal technology; an annual catalog of Government-owned inventories; a directory of Federal technology-transfer contacts; and a directory listing special resources provided by Federal agencies and their laboratories.

Finally, Mr. Chairman, I would like to thank the committee for their favorable report on H.R. 2514, the NTIS technical information clearinghouse fund, known as the revolving fund. As you know, the bill is presently pending before the House Committee on Energy and Commerce. At the request of that committee's chairman, GAO issued a report on the need for the bill. We understand you have reviewed the GAO report which confirmed the need for the fund and agree, as does the administration, with the technical changes recommended in the report. Your leadership will certainly encourage the Committee on Energy and Commerce to act favorably.

This completes my prepared remarks. I would be happy to try to answer any questions you may have.

[The prepared statement of Dr. Caponio follows:]

STATEMENT OF DR. JOSEPH F. CAPONIO, DIRECTOR, NATIONAL TECHNICAL INFORMATION SERVICE, U.S. DEPARTMENT OF COMMERCE

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This completes my prepared remarks. I would be happy to try to answer any questions you may have.

DR. JOSEPH F. CAPONIO

Dr. Caponio was appointed Director of the National Technical Information Service (NTIS) in March 1983, having served as Acting Director since January 1982 and Deputy Director since June 1979.

His information science career includes many top management positions in the Federal Government, i.e., Director of the Environmental Science Information Center of the National Oceanic and Atmospheric Administration, Acting Director of the National Agricultural Library, Scientific and Technical Communication Officer of the National Institutes of Health, Director of Technical Information of the Defense Documentation Center, and Senior Reference Analyst at the Library of Congress.

Dr. Caponio was born in Canton, Massachusetts. He graduated from St. Anselm's College in Manchester, New Hampshire, and earned his Doctorate in Biochemistry at Georgetown University in Washington, D.C. His career as an information scientist spans over 30 years. He has authored numerous papers and has served as an adjunct lecturer at American University and the University of Maryland.

He is a member of the American Chemical Society, the American Society for Information Science, the Epilepsy Foundation of America, and is a Fellow of the American Association for the Advancement of Science.

Mr. **WALGREN**. Thank you very much, Dr. Caponio.

Dr. Merrifield, I know that you have had a personal interest in the research and development limited partnerships, and you indicate that that is an area that still has great potential for the future. Looking back on the last 3 years, how do you assess the pickup in the American economy of that concept?

Dr. **Merrifield**. Well, it was just about a year and a half ago that we developed the guidelines for that, and so the last year, 1983, was the first year really in which there was any significant activity, but we estimate there is something on the order of 750 to a million to a billion dollars of limited partnerships that were formed. Some of these were very large, in the $25 to $100 million range, but most of them very small, in say the half a million to $5 million range. I think that one of the major advantages or opportunities for them is in the small business area, although the problem here has been that the cost of putting them together from a legal point of view has been pretty high.

What has happened now is that E. F. Hutton and Bache and other financial houses are putting together larger blind pools. E. F. Hutton raised $25 million of money, and what they are doing is now funding half a dozen different smaller ones with that $25 million. The Bache initiative will do that, too. This spreads the risk for the individual investor and allows smaller investors to participate and allows them to pick up the smaller but very interesting initiatives that otherwise might not be able to manage the legal and financial costs of raising the money.

Mr. **Walgren**. You indicated that there was a—some kind of a tax guide or some such.

Dr. **Merrifield**. Right. We have a very detailed set of guidelines, it is about 100 pages. It is a tentative set of guidelines and will ultimately be modified, particularly if there are tax changes that come out of the Congress. But they have been very helpful in putting out specific directions for people to set these things up. It has been a very useful device, and we must have sent out thousands of these now.

Mr. **Walgren**. Are they sold or distributed?

Dr. **Merrifield**. They are sold through the NTIS at cost. Maybe, Joe, you can tell me how many have gone out.

Dr. **Caponio**. Approximately a thousand, Mr. Chairman.

Mr. **Walgren**. What is the cost?

Dr. **Caponio**. The cost of reproducing and processing the report, probably about $10.

Mr. **Walgren**. I ought to give you an opportunity to comment on this committee's legislation with respect to joint research and development. As you know, we reported a bill that has, as I understand it now, been referred to the Judiciary Committee.

The greatest sticking point was how to, how to cut off the joint action somewhere short of commercialization, and we had a lot of different views as to how to identify that line.

I am trying to think of exactly how we did it now. Are you familiar with that?

Dr. **Merrifield**. Well, we have been going round and round with all sorts of people on the definition of R&D. It is a difficult thing. I would suggest that it may be more of an academic exercise in the sense that the—all different things, all different types of innovations have different end points.

Basically, the principle is that the intent of the law would be to encourage new innovations rather than cosmetic improvements on old things, and the language would try to make that distinction.

It also would not include building of a manufacturing operation, but would include the costs associated with a prototype demonstration or a pilot plant demonstration if it is chemical or pharmaceutical. But these are difficult language problems, and it is awfully hard to identify that dividing line.

I think that there is basic consensus though on that wording, as it has finally been developed, and I think we are all pretty much satisfied that that is about the best we can do.

Mr. **WALGREN**. You also mention in your statement the development of tax proposals to strengthen the incentives for the research and development limited partnerships. Is that in a form that the committee has or could it be provided to the committee easily?

Dr. **MERRIFIELD**. There is no final form there. Basically what we are suggesting is that one mechanism for encouraging innovation and shifting it from into the earlier stages of the innovation pipeline, which is where the gap in funding now exists, would be to remove the current exclusion on the 25-percent R&D incremental tax credit.

As you know, it is not now allowed only for companies that have been in business at least 3 years. What we would like to do is remove that exclusion and allow it for start-up companies and new ventures and R&D partnerships which would basically increase the tax incentive for the higher risk, longer-type work.

R&D is sort of a capital investment that has to be amortized over the life of the product or process that it produces. It is the only capital investment that we still tax at 50 percent.

If we allowed the incremental tax credit for these sorts of things, it would raise that or reduce that tax from 50 percent to something like 30 percent, which is comparable to other forms of capital investment.

Mr. **WALGREN**. Let me ask, you also indicate that you are increasing the efforts to license commercially valuable inventions that are owned by the Government through the technical information service patent licensing program.

And you go on to say the Center for Utilization of Federal Technology implements the provisions of Section 11, which were essentially transfer provisions as I understand them, transfer efforts, which would have the same purpose as increasing efforts to license commercially valuable ideas. Yet, the Centers for Utilization of Federal Technology are being essentially unfunded or their funding is not being pursued, apparently because of some in-house generation of funds, but it is my understanding that our real effort through the centers has never developed in the way that the Congress asked it to.

And yet, on the other hand, you are recognizing that we have to increase our efforts through the NTIS in this area. If we are deficit in that area, shouldn't we be strengthening both programs?

Dr. **MERRIFIELD**. Well, that is a good question. Let me point out that there really are two fundamental problems here.

One is that in the past, exclusive licenses were not allowed. This is a basic problem to any industry that wants to license a patent. If I license a patent non-exclusively and then spend a lot of money developing it and developing the market for it and then all my competitors can also license the patent and follow me in without making that expenditure, then it is a pretty risky thing for me to do that.

The first thing we have done, the intent of the Presidential memorandum and the Dole bill, is to not only allow agency Government labs, but to require them to grant back exclusive licenses to contractors who do the work and go beyond that in the Government labs and provide rights for individual inventors in the labs and incentives for them to commercialize the technology that may be commercializable, and that is an important initiative.

That removes a barrier which has basically been operating for all this period of time, and that is one of the reasons, as we are making these efforts, that the Center for Utilization of Federal Technology and NTIS has been so successful and has begun to generate rather significant revenues from patent licensing.

The other basic problem, however, is in training the Government labs how to identify what is commercially attractive. This is not an area of their expertise, and one of the initiatives we hope to undertake is to set out a series of guidelines and checklists, a constraint analysis which allows you to identify ideas with commercial potential and then to patent those with potential so they can be licensed back out or granted back to the contractors, as the case may be.

Those are the basic problems that have been sort of barriers to the real utilization of this tremendous amount of money we have put into Government R&D, and I think basically our efforts here are catalytic in nature, but I think that they can accelerate the rate of utilization rather significantly.

It is a judgment factor. Of course, you can always do more, and what we are doing is the best we can.

Mr. WALGREN. Mr. Boehlert?

Mr. BOEHLERT. Thank you, Mr. Chairman.

Dr. Caponio, in your testimony you indicate that the increase in the patent licensing area, the increase of $365,000 this year over last, would reduce the backlog of licensing inquiries.

What kind of a backlog do we have?

Dr. CAPONIO. Congressman, at the present time, we have approximately 100 in the backlog. On an annual basis, the NTIS receives close to a thousand.

Mr. BOEHLERT. That is a pretty significant backlog, isn't it?

Dr. CAPONIO. I would say it is.

Mr. BOEHLERT. Forgive me for this, but in Washington terms, $365,000 almost comes out of petty cash, and when we are dealing with reducing the backlog of licensing inquiries, permitting the promotion of more licensing opportunities, those are very, very important activities.

How much did you request?

Dr. CAPONIO. We requested $365,000.

Mr. BOEHLERT. Is that what you asked for?

Dr. CAPONIO. Yes.

Mr. BOEHLERT. How did you do it?

Dr. CAPONIO. We have a very efficient organization.

Mr. BOEHLERT. Obviously, you are efficient, and your statement indicates that, but that seems to be rather modest. Are you really going to eliminate the backlog with only $365,000, and are you really going to be able to promote more licensing opportunities with that small amount of money?

I am not trying to give away money, but these are worthy objectives.

Dr. CAPONIO. I do think that we will be able to make a substantial reduction in that backlog and it is not so much due to the $365,000 which we hope will be approved, but rather, in the expertise that we have.

At the present time, we have probably the equivalent of 2.5 to 3 professionals who actually execute the licensing of these Government-owned inventions or patents, and I dare say that these gentlemen have a—almost a lifetime of experience.

That is what is required, the experience in being able to prosecute and execute the Government-owned inventions or the patent license, and I am quite confident that with that amount, which will provide the addition of two more professional patent attorneys, that we will be able to significantly reduce the backlog.

Mr. BOEHLERT. Your whole statement is something that deserves commendation, the way your whole operation is functioning. I wish you would write a primer for the rest of the agencies of the Federal Government.

Thank you, Mr. Chairman.

Mr. WALGREN. Thank you, Mr. Boehlert. I admire the restraint in your—who was it, had the admonition to omit needless words, and I do appreciate the fact that your statements are efficient, but you indicate that it is not the $365,000 that is going to be helpful in doing this.

Do you want to qualify that?

Dr. CAPONIO. Well, Mr. Chairman, the $365,000 is certainly required, but the point that I am trying to make is the professional expertise of the individuals who are called upon to actually negotiate and execute the Government-owned inventions and/or patents which is the key to a successful operation.

I might also add that as Dr. Merrifield pointed out in his testimony, that this particular operation is for all intents and purposes self-supporting—because in terms of the royalties received and returned back to the Treasury. I believe in fiscal year 1983 we received and returned approximately $900,000, which offsets the cost of the basic operation.

Mr. WALGREN. Will you be acquiring more people with that kind of expertise, with that $365,000? How is that apportioned among the efforts?

Dr. CAPONIO. We are requesting four additional positions with the $365,000, yes.

Mr. WALGREN. I see. And so, almost all of the $365,000 is going to go for personnel——

Dr. CAPONIO. Plus the costs for—there are three types of costs associated with executing or processing a license. First, there is the up front cost, which varies, and then there is the second cost, which is the maintenance cost and third, the cost for foreign filing.

Also, there are ongoing royalties that are based on the actual sales of the product or the processes.

Mr. **Walgren**. How many people would be involved in the foreign filing aspect in particular?

Dr. **Caponio**. Approximately one-half of the professional expertise is involved in the foreign filing. I would also amplify that the same individuals who prosecute and who execute are also responsible for overseeing that aspect of the program.

We do much of this through other intermediaries on a subcontractual basis.

Mr. **Walgren**. But within the $900,000?

Dr. **Caponio**. Yes.

Mr. **Walgren**. How many individuals are we talking about as a whole?

Dr. **Caponio**. With the additional four we would have nine people operating the patent licensing program.

Mr. **Walgren**. And those people are supposed to range over the total amount of Federal research and development and protect anything there from foreign filings?

Dr. **Caponio**. Those patents which we actually receive and execute., As you probably know, Mr. Chairman, there are several agencies within the executive branch who maintain their own patent licensing activity; for example, NASA, the Department of Energy and segments within the Department of Defense maintain an ongoing patent licensing activity.

So we are not responsible for the entire patent or government inventions being developed throughout the executive branch.

Mr. **Walgren**. But you might say just as a guess that you are probably responsible for $20 billion of it, and I guess you do have to be efficient to cover $20 billion of research in a fiduciary way with nine people?

Dr. **Caponio**. Yes, Mr. Congressman.

Mr. **Walgren**. I see.

Let me ask Dr. Merrifield, is there a dollar amount for the Centers for Utilization of Federal Technology that they will be operating with after they are phased out from appropriated funds? As I understand it, they have certain self-generated funds, and we are hoping that their activities will go on based on that self-generation.

What is the expected dollar level of activity that you would anticipate and hope to happen?

Dr. **Merrifield**. Well, Joe, why don't you answer that?

Dr. **Caponio**. Mr. Chairman, as pointed out in my testimony, we feel that with the development of the many information products and services coming out of the Center, we will be able to maintain that operation also on a self-supporting basis.

In addition to the licensing of government-owned inventions and patents in our licensing program, CUFT the Center will be making available those technologies as a result of our interaction with the Federal laboratory consortium.

Mr. **Walgren**. When you say we believe we will be able to maintain those operations, at what level of maintenance is that? Is there a number we currently put on the size of that effort, and is that number expected to be maintained?

Dr. CAPONIO. My best guesstimate would be approximately a quarter of a million dollars for the maintenance of that activity, which would be maintained as a result of the revenues received into the clearinghouse in the same way that the revenues received support the entire operation of the clearinghouse.

Mr. WALGREN. Please feel free if you want to rethink that number for your own——

Dr. CAPONIO. I would like to be able to check that with the staff and submit it for the record.

Mr. WALGREN. Give us a submission on that question, if you would.

[The information follows:]

Appropriated funding for CUFT was $500,000 for fiscal year 1983 and $495,000 for fiscal year 1984. These amounts included substantial start up costs, initial product development and promotion, and expenses associated with public awareness. These costs are not recurring, consequently anticipated revenues of approximately $250,000 will be sufficient to maintain current efforts in the program.

Mr. WALGREN. Dr. Merrifield, the competitive assessment group was transferred from OPTI. How is that working out and do you still rely on the work of this group; and is it functioning in the new organization?

Dr. MERRIFIELD. Well, that has been transferred or is being transferred into the International Trade Administration, and with a large part of the Bureau of Industrial Economics, and the idea is to basically fragment that capability into a number of about seven or eight different industry sector groups.

That is lost to us in the sense that we no longer have access to either of those groups, from which we really did get a lot of our basic information. We also have, we are carrying on additional studies, however, through an EDA grant, which—into the private sector—which allows us to access the data base that wasn't available through the BIE basically, and which we urgently need, and we are still proceeding to gather that information.

The collating and editing of that data now also has to be contracted out, so we have lost that internal capability to manage that data flow. But that is—but we are still gathering the data that go into the computer simulations in our industry sectors, and we need this for the R&D limited partnership and industry guidance efforts that we make.

Mr. WALGREN. Mr. Boehlert?

Mr. BOEHLERT. On the 3-year extension for the R&D tax credit, you recommended the domestic cabinet council bought, are they selling, are they pushing?

Dr. MERRIFIELD. Yes, indeed. I think that has been the administration position that it should be extended. I think some of the bills that are being introduced would make it permanent, the Danforth bill and others.

At least the position is that it should be extended.

Mr. BOEHLERT. The Danforth bill is one that you would identify with in terms of support?

Dr. MERRIFIELD. I do, yes.

Mr. BOEHLERT. Is there a companion bill in the House that you are aware of?

Dr. **Merrifield**. Yes. I think there are several being incipiently formed, but I don't think any of them are, to my knowledge, finally in. I am not sure about that.

Mr. **Boehlert**. Thank you.

Mr. **Walgren**. Dr. Merrifield, you indicated that it is essential for competitiveness that we be metrified, in your words, and yet, we have seen a decrease in at least the directness of Federal Government activity in the metric area.

Congressman Brown has introduced a bill which would ask for a comprehensive study of the current status of metrification. I would gather from your emphasis that it is essential for us to be competitive in an international economy, that we are probably losing some substantial opportunities for lack of being metrified, and that you would endorse strongly a proposal to get the Congress thinking about this again, and develop an accurate view of where we are and what we are losing.

Dr. **Merrifield**. Well, indeed, I think that our strategies have been basically through the R&D limited partnership consortia and other things of this sort to very strongly urge that all new systems be capable of metric systems, and this has received a lot of recognition now.

I think it is a matter, in many of our industrial operations, of just a little bit of naiveté and ignorance about the significance and importance of being in metric systems when the rest of the world is in metrics.

In fact, all markets are now world markets and this is essential. Our machine tool operations are a classic example where we still operate in the old systems, and yet those are not competitive and cannot be competitive in world markets.

Our strategy has been to encourage the private sector to fund efforts along these lines and increase their funding and again, that is the catalytic agency that we have been operating.

I think—I do agree that it is a very important thing. I think that there is a growing awareness now in industry that this is not only necessary eventually, but right now, and I would hope that we can encourage that very strongly.

Mr. **Walgren**. Do you think that it would be helpful for the Federal Government to be actively looking at this question in hopes that that would at least get the attention of some of the parts of the private sector that in their—as you say, their naiveté or lack of focus on the question, might be missing opportunities that they would otherwise be picking up?

Dr. **Merrifield**. I think indeed, that anything that would aid in sensitizing industry to the need for metrification would be a useful thing.

Again, this has been—we were incorporating this into almost every initiative that we take in the limited partnership areas and all the other outreaches that we are making to industry, competitive assessments as well, so this is a critical thing that we see.

It is just part of everything we are doing. And I think it has already had some effect. I am pretty blunt about these things when I talk to my friends in industry and tell them they better hurry up and wake up, and I think this is an important thing to do.

Mr. **Walgren**. Isn't it also true that the signals with the unfunding of the Metric Board have been all the other way, and although you, I understand, have the sensitivity to appreciate the importance of that, all the signals from the Federal Government have been that somehow or other, this was some change that was sort of being imposed and should be resisted—those last words were probably unstated, but I believe they are very clear in the actions that the Congress took, truthfully.

I don't put this on the Administration. I don't know whether the administration provided funds for that or not, but I know the Congress has been reversing direction, and it is those overregulators again that deserve to be resisted. Somehow or other the metric effort in the Federal Government got caught up in that and ended because of that, in my personal view.

If that is—or to the degree that that is true, we have a proposal now for a $700,000 study of where we are in this. I suppose that could be characterized as an attempt to refocus and get us to think about it again in hopes that there would be more individuals like yourself who would be blunt with everybody they came in contact with in the Federal Government, and that we would make greater progress in that.

Do you think that would be useful?

Dr. **Merrifield**. Yes. I think that—of course, we do have a metric program and budget, there are about five people involved, and this is their—I think initially you are right, that the perception was that there was a disinterest on the part of the Government in metrification, and a lot of people took that as a signal.

I think we have pretty much turned that around. I don't think that that is true any longer. We have made a lot of efforts to make sure that that isn't received as the right signal, and I think there are very few people that have that illusion any longer.

Nevertheless, the sensitization process is a critical one, and that is going to be a persistent need and a persistent effort on our part to make that happen.

Mr. **Boehlert**. Mr. Chairman, at this point, I would like to insert in the record a letter from the President dated April 11, 1983 to the ANMC Conference which was held, at which time he said, "We are behind it."

Dr. **Merrifield**. Yes.

[The letter follows:]

THE WHITE HOUSE
WASHINGTON

April 11, 1983

I am pleased to greet members of the American National Metric Council at your Ninth Annual Conference.

This is the first year the Secretary of Commerce has had the lead Federal responsibility for support of industry's transition to metric measurement. It is gratifying to know that the Department of Commerce is the co-sponsor of the 1983 ANMC Conference.

In the past year, the issue of metric transition has become increasingly important in the area of international trade and productivity. The National Productivity Advisory Committee has recommended that the Federal Government continue to support conversion to metric measurement to enhance U.S. international competitiveness and hence productivity in several industries.

With full cooperation between the public and private sectors, I am confident we can achieve this important goal.

You have my best wishes for a productive and successful meeting.

Ronald Reagan

Mr. Walgren. You do have a five-man metric office following on the work of the previous separate agency, as I recall?

Dr. Merrifield. That is right.

Mr. Walgren. Does that five-man effort have a backlog?

Dr. Merrifield. Well, it is hard to call it a backlog. There are always a lot of things we could do that we don't do, but more of the same kinds of things.

Mr. Walgren. Let me ask it this way, then: As I understood it, they were responding in some sense to requests from the public for information and other things. Is there any backlog in our responsiveness?

Dr. Merrifield. I don't think so. I think our primary thing is really to incorporate the understanding of the need for metrics into systems analysis, the computer simulations and the critical need for economies of scale that result from having this sort of thing operating.

I think as we build—I am convinced that by the end of this decade, almost all manufacturing will be in the form of computer-controlled robotically operated systems that will be flexible manufacturing systems and, of course, the software for those will have to enable those to operate in metric terms, and I think that that process is going to happen rapidly, it is going to be essential if we are going to be in the business, and I think it will develop, but again, the sensitization is the critical need.

Mr. Walgren. Dr. Caponio, the National Technical Information Service is in the business of providing information to the public. How are we doing in terms of the cost-effectiveness of the equipment and resources that we are putting into that effort of supplying technical information to the public?

Are we operating at respectable efficiency in that department?

Dr. Caponio. Mr. Chairman, I believe that the NTIS is certainly operating with the latest equipment and information technology. We do maintain within house, a staff responsible for monitoring the most recent developments in the fields of information technology. We are cooperating with other agencies in the information dissemination business; for example, the Defense Technical Information Center, the Energy Technical Information Center at Oak Ridge and the NASA Scientific and Information Facility.

I think that we are in a position to pioneer the application of the latest information technology to the dissemination of technical information to U.S. business and industry.

Mr. Walgren. That is unusual for the Government, isn't it, inasmuch as the Grace report finds that we do not use computer information processing and the like to the degree that we should and that any modern business would certainly want to?

Dr. Caponio. I believe you are correct. I believe the Grace Commission more or less is concentrating on the use of computers, and I do feel that when we are speaking in terms of the application of information technology to the processing and the dissemination of scientific and technical information handling, we are simply dealing with the application of computer technology, and I believe Dr. Merrifield alluded to the use of interactive videodiscs.

This is looming on the horizon. I dare say that in the next 2 or 3 years, NTIS and other organizations may be making use of the application of optical digital disc technology for the reproduction of many of the technical reports.

This may replace, for example, the microfiche which is used as the secondary medium for the dissemination of the technical report literature today.

I might add that with the approval of the revolving fund, this will certainly help us in acquiring the latest information technology. The latest today happens to be perhaps the optical digital disc technology and at the present time, we would depend very heavily on the use of the revolving fund.

Mr. WALGREN. That was my last question, the revolving fund and what it would do for you. Is that the main benefit that you would get from the revolving fund if we were to get it into place?

Dr. CAPONIO. Essentially, the revolving fund would be equivalent to a line of credit. It would permit the NTIS to retain earnings to invest in capital equipment and inventories, which we cannot do at the present time other than perhaps requesting appropriations through the congressional route.

It would also permit us to take care of the cash flow needs and requirements when revenues may be at a low point, and then we would conversely reimburse the revolving fund as a result of the modification of the prices of our information products and services.

Simply the $5 million revolving fund is a line of credit which would be used for capital equipment, and drawn upon in those times when we have a very low cash reserve, which can be made up subsequently through the modification of price changes in our information services and products.

Mr. WALGREN. Do you have any outstanding requests for equipment improvements at this point?

Dr. CAPONIO. At the moment, we have the latest. As a matter of fact, we utilize the Department's centralized computerized facility, and I would dare say that they are as up-to-date as any facility within the executive branch.

Mr. WALGREN. Well, thank you very much. We certainly appreciate your coming and spending that time with us. We might have some other questions that we would get to you for our own purposes, and you can think about them and respond.

So with that, thank you very much. We appreciate it.

Let me call the next panel, Prof. Karl Steinbrugge, the head of the Emergency Management Agency's Five-Year Plan Review Panel for Earthquake Hazards and Reductions; accompanied by Dr. Walter Stockmayer, the Chairman of the National Bureau of Standards' Visiting Committee.

Dr. Stockmayer is a professor of chemistry at Dartmouth College.

And Mrs. Shirley Prutch, the chairperson of the Evaluation Committee of the Institute for Computer Science and Technology, and Mrs. Prutch is vice president, Accounts Division of Martin Marietta Data Systems.

Welcome to the committee and let me say at the outset that your written statements will be made part of the record and we would appreciate your being able to draw the focus of the oral part of the record as directly as you can to things that you feel are really interesting and worth noting and focusing on.

So let's start in the order that I called you, with Dr. Steinbrugge.

STATEMENTS OF DR. KARL V. STEINBRUGGE, HEAD, FEDERAL EMERGENCY MANAGEMENT AGENCY'S AD HOC FIVE-YEAR PLAN REVIEW PANEL FOR THE NATIONAL EARTHQUAKE HAZARDS REDUCTION PROGRAM; DR. WALTER H. STOCKMAYER, CHAIRMAN, NBS VISITING COMMITTEE, AND PROFESSOR OF CHEMISTRY, DARTMOUTH COLLEGE; SHIRLEY F. PRUTCH, CHAIRPERSON, EVALUATION COMMITTEE, INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY, AND VICE PRESIDENT, ACCOUNTS DIVISION, MARTIN MARIETTA DATA SYSTEMS

Dr. STEINBRUGGE. Mr. Chairman, I am pleased with this opportunity to appear before the committee and discuss the national earthquake reduction program and also its context with the earthquake programs within the National Bureau of Standards.

To establish this context and our interest, that is of the panel in the NBS earthquake programs, some background information may be appropriate.

Thank you for allowing me to condense my remarks. I also hope I might have the privilege to update some of them in light of more recent budget information.

A copy of my revised text is in the hands of your staff. An independent review panel which I chair was established by the Federal Emergency Management Agency in September of 1982 to review and report on the 5-year program plan fiscal year 1983 through 1987 of the national earthquake reduction program.

Specifically, the panel's mission was to conduct "an assessment of its, the plan's, adequacy with respect to such topics as general directions, comprehensiveness, gaps or overlaps and the responsiveness to the objectives of the NEHRP as established by law."

The panel took a very serious view of this, examined what had been submitted, tore much of it apart and started over, believing that there were some things that needed to be done and did prepare a report.

My last meeting with the panel's executive committee was held in December of last year. At that time, all problem areas of special situations were reviewed, including the panel-recommended budget figures for the programs to be administered by NBS, NSF, USGS, FEMA and others.

I will discuss some of the budget aspects a little later on in a broader context. I was specifically asked to comment on the fiscal year 1985 dollar levels which were then contained in H.R. 2465 and to do so, in the context of the panel's recommendations and the administration's proposed budget.

It was noted that the administration budget included no funds for NBS building technology and we also noted that this activity was not to be picked up elsewhere.

Seismic codes and standards are a vital component of this center's activities insofar as the national earthquake reduction program is concerned.

A year ago, the panel recommended $6.6 million for fiscal year 1985 for the development of model seismic codes and manuals for earthquake design practices.

As I mentioned earlier, we looked at it as an overall view and not necessarily the assignment to a specific agency. However, I estimate that about $2 million would have been directly or indirectly NBS functions.

H.R. 2465 included $500,000 for fiscal year 1985, the same as the previous year. This is an absolute minimum and program elimination is inappropriate, as I view it. In the real world of building design, and that is my own background, in construction and seismic areas, earthquake engineering is intertwined with almost all aspects of building construction.

For example, life safety during and after earthquakes involves the integrity of stairs, ceilings, and post-earthquake fire fighting capabilities in addition to the integrity of beams and columns.

While many such activities can be accomplished by universities and by trade organizations, a national viewpoint which is broadly based and without regard to national or regional or product bias is vital to insure a balanced program.

I cannot, therefore, support the elimination of programs in building technology which relate to earthquakes.

Turning now to other agencies, it is surprising and disappointing to see that the proposed earthquake budgets in the U.S. Geological Survey have been reduced from $35 million to $33 million.

H.R. 2465 states $37.3 million, a modest increase, and certainly barely enough to keep up with increased costs. The proposed USGS budget decrease is shortsighted in terms of long-term earthquake hazard reduction.

Without basic research into the causes of earthquakes and the resulting nature of ground shaking, architects and engineers will continue to be limited when designing earthquake-resistant buildings.

Indeed, if we don't know the forces in great detail, how can we design in great detail. Earthquake reduction programs will be restricted in their application of life safety and damage control in the years to come if basic geophysical studies are cut back.

I am not normally in the pipeline to receive budget information as quickly as I might, and there was insufficient information on hand as I prepared these remarks to give my view or the panel's view on the National Science Foundation proposed budget.

It would appear to be essentially the same as that given in H.R. 2465, but the details are unknown.

As in the case of the USGS, the need for continued seismic research by NSF into geophysics, earthquake engineering, and seismic planning is indeed real if we are to save lives and property.

I note with delight—finally, I have a positive statement—I note with delight that the Administration has requested $6 million for earthquake programs within FEMA. This represents about a 50-percent increase over the previous years.

While our panel is from FEMA, we have perhaps an implied caveat or two. The panel has strongly urged FEMA to take a much more active role in earthquake hazard reduction. It is now hoped that earthquake programs within FEMA will become highly effective through leadership, strongly identified with earthquake hazard reduction, and we are dedicated to this program.

In an overall view, it is my personal opinion that the proposed administration budget on earthquake mitigation for 1985 is disappointing and inadequate in particular areas set forth by goals of Congress, although certain bright spots exist.

I will not go into the other details of funding which are included in the written testimony other than to talk on some important new issues which some are not very expensive; some can be, but the concepts are new and ones that have great potential.

Of these important new issues identified by the panel, one was post-disaster mitigation studies. I have investigated earthquakes many times and fall into the category of an earthquake chaser.

Some people chase balances, I chase earthquakes. Much can be learned from these. They are unplanned, unscheduled experiments. As such, one cannot budget for an unplanned, unscheduled experiment.

One has to search in the budget, piggyback, and do all sorts of strange and unusual things to get to these areas. When disasters strike, as they have in Venezuela, where many of the buildings many years ago were designed according to U.S. standards and failed, we indeed have great interest there.

We, the panel, recommend that an initial appropriation of $500,000 be made and given to FEMA on a no-year basis to support comprehensive field investigations which are to be coordinated by FEMA.

In other words, the agencies exist, things will fall between the cracks, FEMA's role in leadership should certainly be there, which brings me to the second topic, FEMA's leadership in earthquakes.

The panel continues to press for a stronger leadership role, because we have a problem of many agencies involved, and things do fall between the cracks, and any agency that is deeply involved in disaster response handles sums of money that make the research elsewhere dwarf by comparison.

There is strong indication that this agency will continue to play a stronger role. We certainly hope that they will.

Finally—not quite finally—but—there has been considerable discussion about a national experimental facility. In earthquakes, we can do much with computers and simulation, but in the final analysis, it is not much different than the other research programs, be they NASA or whatever.

We must test things. Testing buildings is not simple. They are large and expensive. My personal position for many years has been one that we must have such facilities. The caveat I have, we must be very, very careful that we do not build a monument to ourselves that is called a white elephant.

At present, the National Academy of Sciences' National Academy of Engineering is beginning a study. Their evaluation undoubtedly will identify those earthquake hazard reduction activities ~~which~~ cannot be achieved any other way.

Where and how this is to be done, I do not presume to give any opinion or guess at this time.

My last item is modernization of existing engineering facilities. This includes NBS, it includes the universities, and it includes Government laboratories. Primarily through age and use, existing equipment and facilities have become obselete, and in some cases inoperative.

At the same time, technological changes have led to vastly improved equipment. Certainly we have to modernize and modernization of existing facilities is a major goal. The costs we believe to be a modest $10[illegible] million over the next 5 years.

In closing, Mr. Chairman, allow me to state that much progress has been made in the earthquake hazard reduction program, but much still remains to be accomplished to achieve the objectives that were set forth by Congress in passing Public Law 95-124.

Since the panel report was submitted in April 1983, we had not yet seen evidence of adequate funding for these programs.

I thank you for giving me this opportunity to give this presentation. I am prepared to answer any questions that you might have.

[The prepared statement of Dr. Steinbrugge follows:]

TESTIMONY BY

KARL V. STEINBRUGGE

CHAIRPERSON, INDEPENDENT REVIEW PANEL

NATIONAL EARTHQUAKE HAZARDS REVIEW PROGRAM

Mr. Chairman, I am pleased with this opportunity to appear before this Committee and discuss the National Earthquake Hazards Reduction Program (NEHRP) and also its context with the earthquake programs within the National Bureau of Standards (NBS). To establish this context and our interest in the NBS earthquake programs, some background information may be appropriate.

An independent review panel which I chair was established by the Federal Emergency Management Agency (FEMA) in September of 1982 to review and report on the Five-Year Program Plan (FY83 - FY87) of the National Earthquake Hazards Reduction Program. Specifically, the Panel's mission is to conduct "...an assessment of its [the Plan's] adequacy in respect to such topics as general directions, comprehensiveness, gaps or overlaps, and responsiveness to the objectives of NEHRP, as established by law." The Panel, therefore, has significant interest in the earthquake programs within NBS as well as other agencies. The panelists have taken their task seriously, and a final report has been submitted to FEMA. This report includes a careful examination of the programs and their budgetary needs for all involved.

My last meeting with the Panel's Executive Committee was held on December 15, 1983. At that time, all known problem areas and special situations were reviewed, including Panel recommended budget figures for the programs to be administered by NBS, NSF, USGS, and FEMA, among others. This budgetary information is given in Table 1. At this December meeting, the Panel's Executive Committee strongly reaffirmed its position to support Level B funding -- this will be discussed in more detail at a following point.

I was specifically asked to comment on FY85 dollar levels which are contained in H.R. 2465, and to do so in the contexts of the Panel's recommendations and the Administration's proposed budget for FY85. It is noted that the Administration's budget includes no funds for the NBS Center for Building Technology, and this activity is not to be picked-up elsewhere. Seismic codes and standards are a vital component of this Center's activities insofar as the National Earthquake Hazards Reduction Program is concerned. A year ago, the Panel recommended $6.5 million for FY85 for the development of model seismic codes and manuals of earthquake design practices. I estimate that about $2 million would have been directly or indirectly NBS functions. H.R.

2465 included $500,000 for FY85, same as the previous year. This is an absolute minimum, and program elimination is inappropriate as I view the needs.

In the real world of building design and construction in seismic areas, earthquake engineering is intertwined with almost all other aspects of building construction. For example, life safety during and after earthquakes involves the integrity of stairs, ceilings, and post-earthquake firefighting capabilities in addition to the integrity of beams and columns. Integrated building technology such as that conducted by the National Bureau of Standards is required in order to fully implement the specialized research conducted by academia and others. This integrated technology may take many forms, ranging from testing to building code improvements. While many such activities can be accomplished by universities and by trade organizations, a national viewpoint which is broadly based and without regional or product bias is vital to insure a balanced program.

It is surprising and disappointing to see that the proposed earthquake budget for the U.S. Geological Survey has been reduced from $35.524 million (FY84) to $33.138 million (FY85). H.R. 2465 states $37.300 million for FY85 -- a modest increase and certainly barely enough to keep up with increased costs. This proposed U.S.G.S. budget decrease is shortsighted in terms of long-term earthquake hazard reduction programs. Without the basic research into the causes of earthquakes and the resulting nature of the ground shaking, architects and engineers will continue to be limited when designing earthquake resistive buildings. Earthquake hazard reduction programs will be restricted in their applications to life safety and damage control in the years to come if basic geophysical studies are cut back.

There is insufficient information on hand to give the Panel's views on the National Science Foundation's proposed budget. It would appear to be essentially the same as that in H.R. 2465, but details are unknown. As is the case for the USGS, the need for continued seismic research by NSF in geophysics, earthquake engineering, and seismic planning is real.

I note with delight that the Administration has requested $6.096 million for earthquake programs within FEMA; this represents about a 50% increase over the previous year. The Panel has strongly urged FEMA to take a much much active role in earthquake hazard reduction. It is now hoped that earthquake programs in FEMA will become highly effective through leadership strongly identified with earthquake hazard reduction and who are dedicated to this program.

In an overall view, it is my personal opinion that the proposed Administration budget on earthquake mitigation for FY85 is disappointing and inadequate in particular areas for the goals set by Congress, although certain bright spots exist.

TABLE 1

BUDGET SUMMARY
NATIONAL EARTHQUAKE HAZARDS REDUCTION PROGRAM PLAN
(FY 83 - FY 87)

(1,000$)

PROGRAM ELEMENTS	FY 83 (Actual)	Projected in Constant FY 83 Dollars							
		FY 84		FY 85		FY 86		FY 87	
		A	B	A	B	A	B	A	B
I. HAZARD DELINEATION AND ASSESSMENT	16,210	15,210	22,020	16,086	21,916	16,466	23,600	16,466	23,600
II. EARTHQUAKE PREDICTION RESEARCH	14,460	10,390	16,400	10,800	17,700	10,800	21,400	10,800	25,100
III. SEISMIC DESIGN AND ENGINEERING RESEARCH	16,200	22,665	34,400	24,500	37,400	23,925	36,000	21,525	33,500
IV. PREPAREDNESS PLANNING AND HAZARD AWARENESS	4,670	4,850	7,400	5,150	7,150	4,900	6,550	4,125	6,250
V. FUNDAMENTAL STUDIES	11,650	12,550	19,900	13,350	21,600	14,250	24,000	15,250	21,800
NEHRP TOTALS	63,190	65,665	100,120	69,886	105,766	70,341	111,550	68,166	110,250

Funding Levels

I was also invited to comment on entire NEHRP program. Two levels of funding are given in the Panel's Program Plan; these are summarized in Table 1.

1. Level A generally represents the minimum amount required to sustain the currently projected activities; in some instances the amount represents a lower level of activity.

2. Level B includes Level A funding plus amounts needed to maintain these activities and achieve new or expanded goals that are considered essential.

The Panel strongly supports and recommends your support for Level B funding. After reviewing the agencies' programs, current activities, and financing, the Panel adopted Level B because it will make possible more rapid achievements in earthquake hazard reduction. Due to the cumulative effects of budget reductions, inflation in previous years, and higher operating costs, the performance of some programs has actually declined. Although a 45% increase has been recommended over Level A, the total amount for the five year period goes to $490 million from $338 million. This means Level B's yearly average would be about $98 million compared to $67.5 million for Level A. (These figures, of course, can not reflect the Administration's budget which is to be released shortly.) Given the multi-billions of dollars in potential losses from a major or great damaging earthquake, the $490 million Federal investment seems prudent. A new emphasis has been give by the moderate earthquake which struck the California community of Coalinga in 1983, destroying most of its central business district. It restates that a major earthquake in a major population center would be catastrophic on a national scale.

Important New Issues

There are several important issues, some involving budget increases, which should be brought to the Committee's attention. These issues have been reaffirmed by the Panel's Executive Committee within the past 60 days.

1. Postdisaster Mitigation Studies: Major progress in earthquake hazard reduction has been made as a result of field investigations of earthquake disasters in the U.S. and abroad. The studies of actual events from geophysical, engineering, and socioeconomic viewpoints have directly affected professional practice, education, law, public policy, research, and other critical components of disaster mitigation. The Panel recommends that an initial appropriation of $500,000 be made on a "no-year" basis to support comprehensive initial field investigations which are to be coordinated by FEMA.

2. FEMA's Leadership Role in Earthquake: The Panel continues to press for a stronger leadership role by FEMA in the National Earthquake Hazards Reduction Program. FEMA has substantially increased its leadership role over the past year, and there are good indications that this agency will continue to play a stronger leadership role. However, details remain to be worked out, such as the establishment of a strong independent advisory committee and the establishment of an effective Earthquake Branch.

3. National Experimental Facility(ies): The Program Plan includes a new program for a National Experimental Facility or Facilities. The cost for this program is estimated now to be about $350 million. This a very large amount when taken in the context of all of the current agency earthquake budgets; however, the potentials from this specific program are very significant. Theory without experimental testing is wasteful in the long run. On the other hand, the very expensive physical facilities must be cost-effective and able to solve presently ill-defined future experiments. At present, the National Academy of Sciences/National Academy of Engineering is beginning a study which eventually is expected to lead to a decision on the feasibility of such facilities. Their evaluation will

undoubtedly identify those earthquake hazard reduction activities which cannot be achieved in other ways.

4. Modernizing existing earthquake engineering research facilities: Primarily through age and use, existing equipment and facilities have become obsolete and, in some cases, inoperative. At the same time, technological changes have lead to vastly improved equipment. The United States has enjoyed world leadership in earthquake engineering, but much of the earthquake research community is relying on obsolete, incomplete, and inadequate facilities and equipment. Unless corrected soon, this situation will inevitably lead to declines in new knowledge and of professional competence. For researchers to be fully effective, state-of-the-art equipment must be used in concert with better data and improved theories and methods. Thus, modernization of existing facilities is a major goal. The cost is a modest $10 million during the next five years.

In closing, Mr. Chairman, allow me to state that progress has been made in the NEHRP, but much still remains to be accomplished to achieve the objectives that were set by the Congress in passing Public Law 95-124. Since the Panel's report was submitted in April of 1983, we have not yet seen evidence of adequate funding for the programs. I again urge that the Level B figures in Table 1 be given most serious consideration. These figures have been given to FEMA in its leadership role and also have been released in previous testimony.

Thank your for giving me the opportunity to give this presentation.

Mr. **Walgren**. Thank you very much, Dr. Steinbrugge.

Let's go on with the other members of the panel and get the oral testimony completed and then we will return.

Dr. Stockmayer?

Dr. **Stockmayer**. Mr. Chairman, it is a great privilege to come here and represent the National Bureau of Standards' Visiting Committee, which consists, as you know, of three leaders from American high technology industry and two members of the academic scientific community, one of which is myself.

I think the responsibility to come do this is heightened in my mind a little bit by this morning's Herblock cartoon in the Post, emphasizing the importance of the budgetary process as it moves from the White House over here.

First, I would like to make a couple of remarks on the general status and health of the National Bureau of Standards. The quality of scientific effort, it seems to us on the visiting committee, remains remarkably high, very often at the leading edge of modern science, even though it remains related to the central mission of the Bureau as an agency of the Department of Commerce, and that is not easy to do in view of the very obsolescence which Dr. Steinbrugge mentioned and which I will mention again in a few moments.

However, there is a problem with maintaining the scientific competence in some of the crucial areas of metrology, and this was perhaps accentuated when there was a 15-percent reduction in force, as you are aware, in the Bureau, several years ago. But we now are faced in the proposed fiscal year 1985 budget that the administration has submitted, with a 5-year program, of which I guess this is the first year intending to implement some grade reduction.

However, scientists and engineers are—well, they are the real backbone of the effort of the Bureau and any effective grade reduction in that area without, well, really, often harming the activities is going to be difficult to perform, and the visiting committee would like to point out that this apparently modest reduction in the budget is likely to have some dangerous consequences if it isn't examined rather carefully.

Let me turn now to a positive note. The new budget contains a provision of $7 million for three new programmatic initiatives and, indeed, it is a pleasure to see those being recognized.

First, let me comment briefly on the five areas in a section called measurement services, which have to do with improving process control and quality.

The five areas were picked out of 30 possible ones that the Bureau of Management had identified, and the $2.5 million which is now budgeted comes out of some $13.5 million which might have been devoted to importantly developing areas.

I have some experience dating back in the middle sixties with the burgeoning cost of scientific equipment. At that time, there was a committee reviewing the state of chemistry in the United States, a National Academy of Sciences Committee, and my specific task was to look at the cost of what was then called major research equipment in American university departments of chemistry, and a major piece of equipment was anything that cost more than $5,000.

We found that for the 20 years up to 1964, it had been doubling every 6 years.

That isn't inflation, it is the advancing sophistication of scientific knowledge. American science, industry, and technology can't afford to wish that these advances weren't taking place. It is like wishing that Adam hadn't bitten the apple, because knowledge is advancing that fast, and if we are to remain competitive, we have to face up to that.

So I am not asking you to increase the initiatives to a doubling rate of once every 6 years, but to say that the visiting committee strongly endorses the provisions that have been made and hopes that there will be many more in the future.

I will turn to the second programmatic initiative, which was for the development of a program of standards and measurement in the developing area of biotechnology. Well, again, members of this congressional committee don't need to be told about that.

I brought with me yesterday's weekly edition of Chemical and Engineering News, the American Chemical Society publication, and here is a story on page 16 describing a recent report released by the Office of Technology Assessment, and your colleague, Representative Gore, is here depicted as releasing this report with a remark that although biotechnology has been, to date, a success story, there is severe competition ahead.

Well, if it is to enjoy the same support from the Department of Commerce's agency, the National Bureau of Standards, as other parts of American industry has enjoyed, biotechnology very much needs to be able to rely upon a standards program of the type that is available to older industries, so I needn't say any more.

If you would like me to leave this copy here, I will.

[The article follows:]

[From the Chemical & Engineering News, Feb. 6, 1984]

ENSURED FUNDING URGED FOR BIOTECHNOLOGY

The U.S. currently enjoys an enviable competitive edge in biotechnology. But that lead may be eroding. In a new report, Congress' Office of Technology Assessment delineates a number of areas that Congress might want to take a look at to ensure that the U.S. maintains its competitive edge, in the face of serious challenges from Japan and West Germany in particular.

In general, OTA finds that if federal funding for basic life sciences research continues to decline, the science base, which supports innovation in biotechnology as well as in other fields, may be eroded and that federal funding of generic applied research and personnel training in the areas of bioprocess engineering and applied microbiology may be insufficient to support rapid commercialization. However, the biggest problem may be ensuring the continued availability of financing for new biotechnology firms until they are self-supporting.

In releasing the report, Rep. Albert Gore Jr. (D-Tenn.), chairman of the Science & Technology Subcommittee on Investigations & Oversight, noted that "biotechnology has, to date, been an American success story. A wise government investment has created a burgeoning and pre-eminent industry, which creates jobs and helps our trade balance. It is imperative that we do not let this advantage slip away from us, and we need to ensure that this industry is not crippled."

Among ways Congress could help is to provide more money for generic applied research in biotechnology. As OTA points out, in fiscal 1983 the federal government spent $511 million on basic biotechnology research, compared to $4.6 million on generic applied research. The agency defines generic applied research as that aimed at the solution of general problems associated with use of a technology by industry and which it sees as a government responsibility because it ultimately contributes to the public good and is high-risk and too expensive for individual firms.

Congress also could help new biotechnology firms obtain the financing they need for production scaleup, which OTA says may prove to be an insurmountable problem for some firms because their ability to self-finance may be some five to 10 years away. Congress could provide guaranteed loans for production scaleup. The federal agency, perhaps a "Biotechnology Development Bank," guaranteeing a loan would purchase a stated percentage of the loan if the borrower defaulted. The loans would be guaranteed at less than prevailing interest rates and would thus decrease the cost of capital for the individual firm.

OTA says that Congress might also want to consider allowing rapid depreciation, perhaps over six months, for capital assets required for production scaleup, refunding the R&D tax credit to new biotechnology firms that are not earning enough taxable income on which to apply the R&D tax credit, and amending the tax laws to encourage broader use of R&D limited partnerships.

Copies of the OTA report, "Commercial Biotechnology: An International Analysis," are available from the U.S. Government Printing Office, Superintendent of Documents, Washington, D.C. 20402.

Dr. STOCKMAYER. The third program initiative is for a start on the development of what could be really a major boon to an important part of American materials industry, a cold neutron facility at the National Bureau of Standards' nuclear reactor, which would very much enable the research and control on the ultimate strength properties of various kinds of materials and on the performance of catalysts in various parts of the chemical industry to be pursued in a way heretofore not available in the United States or really readily anywhere in the world.

Slow neutrons, because of their high penetrating power, which is, of course, nondestructive at the same time, can really uniquely probe the structures of certain kinds of materials, and it is the flaws in structure that lie at the heart of these strength properties. (The weakest link in the chain theory has never been displaced in this area, and is still true.)

The world's leading research facility of this kind at the moment is in Grenoble, France. It is a collaborative Western European effort, and I know some American scientists who have managed to go there and make some measurements which were actually crucial to their programs, but there are many more who wish they could have done it. American industry has lots that could be done in this area if such a facility were available on a user pay basis, and the initiative that is in this budget is getting that thing started. If it works as well as anticipated, you can expect requests for enlargement in the future, and the visiting committee feels strongly that this is an important thing to pursue.

I can't say anything more than the many eloquent things that have already been said about the Fire Research Institute, the Building Research Institute and the Institute for Computer Science and Technology, because these are not my area of primary expertise. The visiting committee notes the proposal, once again, to cut the first two and reduce the budget of the third, and views these with alarm. We have talked amongst ourselves of the proposal to move these activities more to the private sector, but there is no viable way to do this that any of us has been able to envisage.

Dr. Steinbrugge mentioned the importance of the building research at the Bureau, and its essential activity, and I imagine you will hear from Mrs. Prutch about the ICST.

I referred you in my written statement to some of last year's testimony. I would like to say that, among those which seem to me very succinct and to the point, you could add the written statement that you received last Thursday from Dr. W. P. Slichter, the chairman of the board on assessment of NBS programs.

The visiting committee is also pleased that, after some years of delay, a really adequate large computer for research is provided for in the current budget to help the Bureau of Standards scientists go about their business. You could almost say, if it goes through, with a big sigh of relief, that at last they can get back to competitive work.

I will say that my own connection with the Bureau, aside from visiting committee work, has been also due to some considerable interest in standard reference data—highly evaluated data—in which the Office of Standard Reference Data, at the Bureau is a leader. The Bureau plans to increase activity in this area in the future. It is not in this year's budget, but when it comes along, I would like already to put in a plug for it, for personal reasons.

At this time, I want to thank you and your colleagues again for inviting me here, and to state that my face turned green at the generous introduction earlier in the day. I also express my willingness to answer questions.

Thank you.

[The prepared statement of Dr. Stockmayer follows:]

STATEMENT OF

WALTER H. STOCKMAYER
PROFESSOR EMERITUS, DEPARTMENT OF CHEMISTRY
DARTMOUTH COLLEGE

CHAIRMAN
NATIONAL BUREAU OF STANDARDS VISITING COMMITTEE

BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

ON AUTHORIZATION OF APPROPRIATIONS FOR THE ACTIVITIES OF
THE NATIONAL BUREAU OF STANDARDS

FEBRUARY 7, 1984

As Chairman of the Statutory Visiting Committee for the National Bureau of Standards, I am pleased to appear before this Senate Subcommittee on Science, Technology, and Space to present our Committee's views on the Bureau. Besides myself, the Visiting Committee has four members: Dr. Russell G. Meyerand, Jr., Vice President for Research and Development at United Technologies, Dr. Bernard M. Oliver, Vice President (Retired) of Hewlett Packard Company; Dr. Robert H. Pry, Consultant, Gould, Inc., and Dr. Norman F. Ramsey, Higgins Professor of Physics at Harvard University. As you know, the Committee meets twice a year and reports annually to the Secretary of Commerce on the Bureau's technical activities. In doing so, the Committee benefits greatly from the reports of panels under the Board of Assessment chaired by Dr. William P. Slichter of Bell Laboratories, who testified on behalf of NBS on February 2nd. These panels examine the work of the National Measurement and Engineering Laboratories, the Institute for Computer Sciences and Technology, and the Center for Materials Science.

The last meeting of the Visiting Committee was held just a week ago, January 31, in the Bureau of Standards Boulder Laboratories. At that time, the Director of the Bureau, Dr. Ernest Ambler, reviewed the FY 1985 budget for us, and we had an opportunity to discuss some of the issues that it raised.

The Visiting Committee strongly supports the proposed program initiatives, relating as they do to the central mission of NBS. The

PROJECTED $2.5 MILLION TO STRENGTHEN THE SCIENCE BASE FOR FUNDAMENTAL MEASUREMENTS AND STANDARDS IN FIVE AREAS IS A MODEST FRACTION OF A CONSIDERABLY LARGER SUM THAT COULD BE JUSTIFIED FROM A TECHNOLOGICAL POINT OF VIEW. AS THE COMPLEXITY OF SCIENTIFIC INSTRUMENTATION INCREASES WITH THE ADVANCE IN BASIC KNOWLEDGE, THE COST OF RESEARCH IN MEASUREMENT AND STANDARDS INEVITABLY INCREASES FASTER THAN THE RATE OF MONETARY INFLATION. AND OF COURSE THE UNITED STATES WILL NOT STAY COMPETITIVE FOR VERY LONG UNLESS WE USE THE BEST AVAILABLE METHODOLOGY. FOR EFFECTIVE PROCESS AND QUALITY CONTROL, BOTH SPEED AND ACCURACY ARE ESSENTIAL. LET ME GIVE YOU A SMALL EXAMPLE RELATED TO ONE OF THE PROJECTED AREAS WITH WHICH, EVEN AS A CHEMIST, I AM SLIGHTLY FAMILIAR. TO MEASURE THE A.C. IMPEDANCE OF AN ELECTRICAL CAPACITOR OVER THE RADIO FREQUENCY RANGE IN 1970 WOULD HAVE TAKEN AT LEAST HALF AN HOUR OF DIAL TWIDDLING WITH A STANDARD COMMERCIAL IMPEDANCE BRIDGE, PLUS SOME TIME FOR DESK-TOP CALCULATION. TODAY, WITH COMPUTER-AUTOMATED DATA ACQUISITION AND PROCESSING ON THE KIND OF EQUIPMENT DEVELOPED AT NBS, WE CAN OBTAIN MUCH MORE PRECISE AND EXTENSIVE RESULTS IN ABOUT A MINUTE--BUT AT EIGHT TO TEN TIMES THE COST! EVEN WITH A 9 PERCENT ANNUAL BUDGET INCREASE FOR MEASUREMENT SCIENCE, THE NUMBER OF CALIBRATION SERVICES OFFERED BY THE BUREAU HAS DECREASED BY ABOUT 40 PERCENT OVER THE PAST DECADE. HERE I WOULD LIKE TO QUOTE FROM A RECENT EDITORIAL BY WALTER J. BOJSZA IN MICROWAVES & RF:

"Since Congress established the National Bureau of Standards (NBS) in 1906 (*sic*), it has grown to be the uncontested world leader in measurement sciences. Government policies now threaten that preeminent position, and the leaders of the high-frequency industry seem ready to watch the NBS's demise in silence.

The U.S. national measurement system, which the NBS maintains and monitors, nurtures every element of American science and industry. Equity in trade, progress in science, universality in engineering, and quality in production all depend on the Bureau's development and dissemination of measurement standards. For such a vital service, NBS consumes a minuscule portion of the mammoth annual Federal outlay. Even so, Administration planners have grabbed it by the budget and are squeezing hard...

Some of the finest measurement experts anywhere are retiring or otherwise leaving NBS, and they are not being replaced. The overlap and the continuity needed to preserve this critical expertise is being lost. Important work involving the measurement of power density, field strength, pulse risetime, phase

> SHIFT, VOLTAGE, MODULATION, PHASE NOISE, HIGH POWER, ATTENUATION, AND NOISE TEMPERATURE ISN'T BEING DONE, EVEN THOUGH MILITARY AND COMMERCIAL SYSTEMS ARE BEING PUSHED TO EVER HIGHER FRQUENCIES AND OPERATING LIMITS."

GIVEN THIS SITUATION, THE VISITING COMMITTEE FEELS THAT EVEN THE MOST WELCOME PROJECTED $2.5 MILLION INCREASE WOULD, TO MIX METAPHORS, DO LITTLE MORE THAN KEEP THE ICEBERG AFLOAT.

THE SECOND INITIATIVE OF $3 MILLION IS TO DEVELOP A MEASUREMENTS AND STANDARDS BASE FOR THE EMERGING BIOTECHNOLOGY INDUSTRIES. MODERN MOLECULAR BIOLOGY HAS SPAWNED SCIENTIFIC AND ENGINEERING DEVELOPMENTS THAT WILL REVOLUTIONIZE CERTAIN AREAS OF CHEMICAL MANUFACTURE, AGRICULTURAL METHODS, AND THE PRODUCTION OF PHARMACEUTICAL MATERIALS. THOUGH THE START CAME FROM TRADITIONAL BIOLOGICAL DISCIPLINES SUCH AS BIOCHEMISTRY AND GENETICS, THE INDUSTRIAL APPLICATIONS LEAN MORE (BUT NOT EXCLUSIVELY) ON THE METHODS OF CHEMISTRY, PHYSICS AND CHEMICAL ENGINEERING. A NEW INTERDISCIPLINARY KIND OF MANUFACTURING ACTIVITY IS EMERGING. IT WILL NEED THE SAME KIND OF SUPPORT--THE THEORY, DATA, MODELS, AND REFERENCE MATERIALS--THAT NBS HAS LONG GIVEN TO STANDARD ENGINEERING AND CHEMICAL INDUSTRIES. THIS KIND OF SUPPORT, WHICH IS ESPECIALLY IMPORTANT FOR THE SMALL FIRMS THAT WILL NATURALLY BE INVOLVED, IS NOT READILY IF AT ALL POSSIBLE IN THE PRIVATE SECTOR.

THE FINAL INITIATIVE AT $1.5 MILLION WILL PROVIDE FOR APPLICATIONS OF A COLD NEUTRON SOURCE AT THE NBS REACTOR TO AID CRUCIAL MATERIALS RESEARCH AND DEVELOPMENT. QUESTIONS OF MAGNITUDE, EXPENSE, AND NECESSARY SAFETY REGULATION WOULD PREVENT ANY SUCH DEVELOPMENT IN THE PRIVATE SECTOR, WHICH HOWEVER IS SURE TO BE THE PRINCIPAL USER OF THE FACILITY. WITHOUT GOING INTO GREAT TECHNICAL DETAIL, LET ME SIMPLY POINT OUT THAT MANY OF THE CRUCIAL ULTIMATE MECHANICAL PROPERTIES OF BOTH METALLIC AND NON-METALLIC MATERIALS (E.G., STRENGTH, TOUGHNESS, FATIGUE RESISTANCE) ARE RELATED NOT ONLY TO THE OVER-ALL MOLECULAR COMPOSITION BUT ALSO TO THE MORPHOLOGY, OR ORGANIZATIONAL STRUCTURE AT VARIOUS DEGREES OF RESOLUTION, AND TO THE PRESENCE OF VARIOUS KINDS OF DEFECTS FROM REGULAR STRUCTURE. THE SCATTERING OF SLOW ("COLD") NEUTRONS PROVIDES A POWERFUL AND OFTEN UNIQUE WAY TO MEASURE SUCH STRUCTURAL FEATURES. MATERIALS SCIENTISTS HAVE WORKED HARD FOR MANY YEARS ON ULTIMATE MECHANICAL PROPERTIES, BUT COMPLETE AND RELIABLY PREDICTIVE UNDERSTANDING IS STILL A DISTANT AND PERHAPS UNATTAINABLE GOAL. THUS EXPERIMENTAL WORK RELATING THE FAILURE PROPERTIES OF MATERIALS TO THEIR MORPHOLOGICAL STRUCTURE HAS BEEN, AND WILL LONG REMAIN, OF CENTRAL IMPORTANCE. THE NEUTRON SOURCE WOULD BRING A NEW DIMENSION TO SUCH WORK, AT BOTH FUNDAMENTAL AND MORE PRACTICAL LEVELS. THE PLAN IS TO PROVIDE A USER FACILITY AT WHICH AMERICAN INDUSTRY CAN WORK TO IMPROVE THE QUALITY AND RELIABILITY OF ITS PRODUCTS. THE PROPOSED APPROPRIATION WILL GET THINGS STARTED; IF, AS WE EXPECT, THE FACILITY BECOMES OVERSUBSCRIBED, THE NBS REACTOR IS SO DESIGNED THAT ADDITIONAL ACCESS PORTS FOR SLOW NEUTRON SCATTERING MEASUREMENTS COULD BE CONSTRUCTED.

WHILE THE VISITING COMMITTEE ENTHUSIASTICALLY ENDORSES ALL THREE INITIATIVES, THEY ARE DISMAYED TO LEARN THAT THE CENTERS FOR FIRE RESEARCH AND BUILDING TECHNOLOGY ARE AGAIN IN JEOPARDY, AND THAT THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY IS TO BE GREATLY REDUCED. THE ADMINISTRATION'S POSITION APPEARS TO BE THAT STATE AND LOCAL GOVERNMENTS AND THE PRIVATE SECTOR SHOULD TAKE GREATER RESPONSIBILITY FOR THESE PROGRAMS. HOWEVER DURING THESE SAME HEARINGS A YEAR AGO, SOME 70 PEOPLE FROM 60 DIFFERENT ORGANIZATIONS SUPPORTED FULL FUNDING FOR THE FIRE AND BUILDING PROGRAMS, ARGUING THAT THEIR ELIMINATION WOULD BE ILL-ADVISED. ABOUT 40 PEOPLE FROM 30 ORGANIZATIONS ARGUED EQUALLY STRONGLY AGAINST THE PROPOSED DECREASES FOR THE INSTITUTE OF COMPUTER SCIENCES AND TECHNOLOGY. WE BELIEVE THAT THE SUBSTANCE AND QUALITY OF THEIR ARGUMENTS ARE AS PERSUASIVE TODAY AS YOU APPARENTLY FOUND THEM TO BE LAST YEAR WHEN YOU VOTED TO RESTORE THE PROGRAMS. TO OUR MINDS, NOTHING HAS CHANGED. WE HAVE DISCUSSED THE ISSUE EXTENSIVELY AND SEE NO WAY IN WHICH THE PRIVATE SECTOR OR THE STATE AND LOCAL GOVERNMENTS COULD PERFORM THESE FUNCTIONS. I CAN OFFER NO BETTER SUPPORT FOR THESE PROGRAMS THAN TO REFER YOU TO LAST YEAR'S TESTIMONY.

I WOULD NOW LIKE TO ADDRESS IN SOMEWHAT MORE DETAIL THE PROPOSED ELIMINATION OF THE REMAINING $1.25 MILLION IN THE MEASUREMENT ASSURANCE PROGRAM (MAP) AND THE REDUCTION OF $100,000 IN THE STANDARD REFERENCE MATERIALS (SRM) PROGRAM.

THE VISITING COMMITTEE APPRECIATES THE ADMINISTRATION'S POSITION THAT THE COST OF PROVIDING SUCH SERVICES SHOULD BE BORNE BY THOSE WHO BENEFIT DIRECTLY FROM THEM. BECAUSE THIS IS A PARTICULARLY COMPLEX QUESTION THAT AFFECTS ALL THE BUREAU'S MEASUREMENT SERVICES, THE COMMITTEE DISCUSSED IT AT SOME LENGTH AT OUR MEETING JUST A WEEK AGO. AS A RESULT, WE WOULD LIKE TO RECOMMEND TO YOU THE ADOPTION OF A GENERAL POLICY ON USER FEES, NAMELY THAT THE USER BE CHARGED THE INCREMENTAL COST OF DELIVERING THE SERVICE BUT NOT THE COST OF THE RESEARCH ON WHICH THAT SERVICE IS BASED. ACCORDINGLY, WE WOULD PROPOSE THAT THE RESEARCH AND DEVELOPMENT ASSOCIATED WITH THESE PROGRAMS CONTINUE TO BE SUPPORTED ON APPROPRIATED FUNDS.

LET ME OUTLINE THE REASONING BEHIND THIS RECOMMENDATION. THE VISITING COMMITTEE BELIEVES THAT SOME CHARGE TO THE USER IS NECESSARY NOT ONLY TO HELP IN FUNDING THE SERVICES BUT ALSO TO ENSURE APPROPRIATE USE OF NATIONAL RESOURCES. BUT THE BUREAU IS NOT A BUSINESS. ACCORDING TO ITS MISSION, IT HAS A RESPONSIBILITY TO THE PUBLIC. AS SUCH, IT CONDUCTS RESEARCH; AND THE RESEARCH IT CONDUCTS IN ASSOCIATION WITH ITS MEASUREMENT SERVICES IS ESSENTIALLY NO DIFFERENT FROM THE RESEARCH IT CONDUCTS IN ITS OTHER PROGRAMS: THE RESULTS ARE DISSEMINATED THROUGH PUBLICATIONS IN PROFESSIONAL JOURNALS, PRESENTATIONS AT SCIENTIFIC MEETINGS, AND PARTICIPATION ON VOLUNTARY STANDARDS COMMITTEES.

IN RESPONSE TO THE ADMINISTRATION'S POLICY ON COST RECOVERY, THE BUREAU HAS BEEN EXPERIMENTING WITH ITS PRICES. WHILE THE DATA AVAILABLE SO FAR ARE NOT CONCLUSIVE, THEY DO SUGGEST THAT CUSTOMERS HAVE A FIXED AMOUNT OF MONEY TO SPEND AND WILL RESPOND TO PRICE INCREASES BY USING FEWER SERVICES. IT IS PERHAPS NOT SURPRISING THAT SALES TO STATE AND LOCAL GOVERNMENTS, HOSPITALS, AND SMALL BUSINESSES ARE PARTICULARLY SENSITIVE TO PRICE. RAISING PRICES TENDS TO REDUCE THE DEMAND FOR NBS SERVICES, EXCLUDING SOME OF THE SMALLER CUSTOMERS ENTIRELY. THE USE OF SECONDARY STANDARDS LABORATORIES, WHILE STRONGLY ENCOURAGED BY NBS, REDUCES STILL FURTHER THE DEMAND FOR THE BUREAU'S SERVICES WITHOUT REDUCING THE COST OF THE ASSOCIATED RESEARCH AND DEVELOPMENT. TO SUPPORT THESE PROGRAMS EXCLUSIVELY ON USER FEES WOULD MEAN REDIRECTING THEM WITH THE SOLE PURPOSE OF MAXIMIZING INCOME.

THE VISITING COMMITTEE THEREFORE RECOMMENDS THAT THE $100,000 CUT FROM THE STANDARD REFERENCE MATERIALS PROGRAM BE RESTORED AND THAT THE $1.25 CUT FROM THE MAP PROGRAM BE RESTORED AND REPROGRAMMED INTO RESEARCH AND DEVELOPMENT OF CALIBRATIONS. AS DR. JOHNSON EXPLAINED IN THE HEARING BEFORE THIS SUBCOMMITTEE LAST WEEK, MAPS DIFFER FROM CALIBRATIONS IN THAT THEY CHECK THE USER'S ENTIRE MEASUREMENT PROCESS, NOT JUST HIS MEASUREMENT STANDARD. AS SUCH, MAPS ARE EXPENSIVE SERVICES TO DEVELOP, OFTEN REQUIRING SEVERAL YEARS OF RESEARCH. A RECENT SURVEY OF NATIONAL MEASUREMENT REQUIREMENTS CARRIED OUT BY THE NATIONAL CONFERENCE OF STANDARDS LABORATORIES SUGGESTS THAT MANY OF THE NEW MEASUREMENT REQUIREMENTS COULD BE MET BY TRADITIONAL CALIBRATION

SERVICES RATHER THAN THE MOSE EXPENSIVE MAPS. THIS IMPRESSION IS CONFIRMED BY THE MANY FORMAL VISITS THAT NBS MANAGERS HAVE MADE TO CALIBRATION AND OTHER METROLOGY LABORATORIES THROUGHOUT INDUSTRY. THE VISITING COMMITTEE IS THEREFORE RECOMMENDING THAT NEW MAPs BE DEVELOPED ONLY WHERE THE USERS ACCEPT THE FULL COST, AND THAT THE APPROPRIATED FUNDING FOR RESEARCH IN MAPs BE REPROGRAMMED INTO CALIBRATIONS. AT THE SAME TIME, WE WOULD STRONGLY ENCOURAGE NBS TO CONTINUE TO PROVIDE MAP SERVICES IN THE TEN AREAS WHERE THEY HAVE ALREADY BEEN DEVELOPED AND WHERE THE DELIVERY COSTS CAN BE RECOVERED FROM USER FEES.

FINALLY, I WOULD LIKE TO ADDRESS THE PROPOSED REDUCTION IN THE PROPORTION OF PROFESSIONALS AND MANAGERS IN GRADES GS-11 TO 15. THE VISITING COMMITTEE IS CONCERNED THAT THIS REDUCTON, WHICH IS PART OF FIVE-YEAR EFFORT, WILL HAVE A DISASTROUS EFFECT ON THE BUREAU'S ABILITY TO HIRE AND PROMOTE ITS MOST VALUABLE STAFF--THE PROFESSIONAL SCIENTISTS AND ENGINEERS. IT SEEMS LIKELY THAT IN ORDER TO EFFECT THE REDUCTION, THE DEPARTMENT WILL PLACE A PARTIAL FREEZE ON HIRING AND WILL INSIST ON REVIEWING ALL HIRES AND PROMOTIONS.

IN CONCLUSION, I WOULD LIKE TO EXPRESS MY THANKS FOR THIS OPPORTUNITY TO EXPRESS MY OWN VIEWS AND THOSE OF THE VISITING COMMITTEE ON THESE IMPORTANT MATTERS.

BIOGRAPHY OF DR. WALTER H. STOCKMAYER

Born: April 7, 1914, Rutherford, New Jersey.

Education: B.S., Physical Chemistry, M.I.T., 1935; Ph.D., Chemistry, M.I.T., 1940; B.Sc., Oxford, 1937; Honorary Doctorate, University Louis Pasteur, Strasbourg, 1972.

Professional Experience: 1939-41, Instructor, Chemistry, M.I.T.; 1941-43, Instructor, Chemistry, Columbia University; 1943-46, Assistant Professor, Chemistry, M.I.T.; 1946-52, Associate Professor, Physical Chemistry, M.I.T.; 1952-61, Professor, Physical Chemistry, M.I.T.; 1954-55, Guggenheim fellow; 1961-present, Professor, Chemistry, Dartmouth College.

Consultation, Memberships in Professional Societies: 1945-present, Consultant, E.I. du Pont de Nemours & Co.; 1963-66, Trustee, Gordon Research Conferences; 1956-present, Member, National Academy of Sciences (Executive Committee, Assembly of the Mathematical and Physical Sciences, 1974-77); American Chemical Society; American Physical Society (fellow); American Academy of Arts and Sciences (fellow).

Awards: Manufacturing Chemists Association Teaching Award, 1960; Polymer Chemistry Award, 1965 (American Chemical Society); Peter Debye Award, 1974 (American Chemical Society); American Physical Society Polymer Physics Prize, 1975.

Areas of Expertise: High Polymers; Applied Statistical Mechanics; Physical and Macromolecular Chemistry.

Mr. **WALGREN**. Thank you very much, Dr. Stockmayer. We certainly appreciate the directness of the views, and that is very helpful in the congressional process, because in supporting what the committee does in these areas, we really do need the direct statements of people of some independent views who are close enough to the programs to understand their value, and I know that members are very quick to recognize the value of that kind of testimony.

So we certainly appreciate those statements.

Mrs. Prutch?

Mrs. **PRUTCH**. Thank you, Mr. Chairman.

It is a pleasure to be here today before you, though I will tell you, when I was called, I thought, thank you very much for the invitation, but no, thank you. When I found the reason for the invitation, it seemed to me that it was appropriate that in place of the written testimony, which I have given to you, a succinct statement might be better, since Mr. Burrows last week did give to the committee what the ICST had been doing.

I would tell you I am one of those people that believe most of the industry activity that has been given to industry and to the public sector from Government has been done better, so this is being on the other side of the fence for me when I tell you I believe ICST does profitable work that the Government needs, and that it cannot be done by private industry.

The standards that the ICST has set and continues to try to establish needs to be done. Industry, for the reasons in my testimony, cannot take over this type of environment. For one thing, they have the antitrust laws to contend with.

For another, we in industry with proprietary information do not trust one another, because we definitely want that competitive edge.

We need it to succeed and make our bottom line profitable. But we also cannot agree when it comes to even such mundane things as word processing standards as to how one corporation should have one such standard.

We can't make that happen as a corporation. Many corporations can't unless it is legislated, and I believe the ICST is doing an excellent job and does better each year in their worldwide representation and also in what they are doing within our country.

They are well known. They are respected, and they are viewed as a nonbiased group of professional people. I believe they are an asset. I do not believe that the current budget will allow them to do any amount of productive work, and this is probably a statement that I am not sure the ICST group would agree with.

I am not close enough to their budget to be able to assess each and every item, but it would appear to me that on the surface, a $5 million budget will not allow them to do any of the work that has been set forth for them.

I believe they cannot fulfill the mandate which has been set that they are to fulfill, and therefore, it would seem to me that if $5 million is all that is available, it might be best to say this is a mandate we as the Government does not believe needs to be fulfilled and the ICST should be disbanded.

I believe they need adequate funds so that you can judge them on the work that is done.

Thank you.

[The prepared statement of Mrs. Prutch follows:]

Mr. Chairman and Members of the Subcommittee:

I am Shirley Prutch, Vice President, Martin Marietta Data Systems. I have served on the ICST Evaluation Panel for the last three years and now chair the Panel. Thank you for inviting me to talk with you today. To make sure that we are dealing within the same framework, I would first like to review ICST's legislative mandate and tell you what I believe to be its implications. ICST's primary charter comes from the "Brooks Act" which directs the Department of Commerce to develop standards and guidelines which lead to "the economic and efficient purchase, lease, maintenance, operation and utilization of automatic data processing equipment" within the Federal Government (PL 89-306) and to conduct whatever research is necessary to meet that goal.

The Panel has found that ICST must engage in a broad range of activities in order to fulfill this mandate since most organizations could write standards and guidelines, for that is relatively easy to do. One problem, however, comes when those standards and guidelines are translated into real equipment to be used by ordinary people under normal work conditions. Proper research is required in consultation with the manufacturing industry if industry is to build to the standard. Similarly, if staffs have not been given appropriate guidance, very few agencies will be able to use the equipment "economically and efficiently." ICST, therefore, spends a great deal of time working with the vendors and the agency users and, the Evaluation Panel believes, does so with very good effect.

Problem two comes when you convert from equipment which has been custom-built to the specifications of one particular user (in this case the Federal Government) to equipment which can be bought off-the-shelf by all users. It is only when you get to an "off-the-shelf" position that real economies can be realized. The Federal Government, even with its enormous resources, cannot bring that position about by itself. The Federal Government buys about 6 percent of the ADP (automatic data processing) equipment sold in the United States and even though that represents a huge federal investment it is not a sufficient market to cause standardization. In order to do that, ICST must aggregate a market of State and local governments and industry ADP users. Therefore, the Institute works with many of the large users in order to educate them and to ascertain their needs. ICST then brings those needs to the national and international voluntary standards committees where, to a large extent, the vendors are the dominant players.

As the unbiased leader of an unofficial coalition of users, ICST is able to demonstrate that a worthwhile market exists, and as a premier research agency, ICST is able to lead the voluntary organizations toward technically sound standards that result in off-the-shelf products--to the benefit of all of us.

This method of working has a number of important side effects--all of them good. In the international arena, ICST has been instrumental in preventing foreign competition from using standardization as non-tariff trade barriers. By ensuring that technical specifications do not discriminate against U.S. vendors, the Institute has effectively protected our trade interests. More importantly, ICST's standardization work has also laid the groundwork for significant innovation by the computer and telecommunications industry. Perhaps it is appropriate to spend a few moments discussing the relationship between standardization and innovation.

Thinking through and in discussion with various colleagues about this subject, I became informed of a draft of a contractor's report which had been prepared for the Office of Technology Assessment. According to my colleague, the report distinguishes between product standardization and system standardization as well as between proprietary information and non-proprietary information. (This is an important point in the discussion of ICST's role within the standardization world, because some people have suggested that the private sector can do the job.) A product is generally standardized through market-place usage; a number of different products are marketed and users gradually converge on the ones whose properties are most useful. This happens over a long period and official standardization takes place late in the process--usually after a de facto standard exists, i.e., the product which meets most users' needs is the product around which convergence happens. A system, however, requires standardization much earlier because basic connections must be in place before system innovation can be explored; meaning that the market testing, which precedes the standardization of a product, generally does not take place when the issue is a system. This is where ICST's testing laboratories assume an important role. The proposed standard interfaces for computer/communications systems are tested in the laboratories to make sure that they "work." In cooperation with individual firms, proprietary systems are tested to make sure that they "work" with the interfaces. With that assurance, industry can go about its process of system innovation with confidence.

The industry relies on ICST to provide a "neutral" ground for the testing of these interface standards because such standards deal with nonproprietary matters. Certain information and research results are proprietary to the companies which develop them. Other things, standards among them, are shared by an entire industry. Individual companies put most of their R&D resources into those things which are proprietary because that is where they get the greatest return on their individual investments. There are very few mechanisms available for cooperative participation in the research and development of nonproprietary material--partly because of our anti-trust laws and partly because the companies, in fear of jeopardizing their competitive positions, will not divulge to one another the proprietary information needed to develop standards which must be used by all. ICST provides a trusted mechanism, as well as the synergy, for building the nonproprietary knowledge base which is essential to proprietary innovation.

Having presented what I have been told is the basis of the report prepared for the Office of Technology Assessment, you might choose to read that report. I look forward, naturally, to being able to do so as well.

Let me return now to ICST's method of working. I referred earlier to its usual method of working through the voluntary standards committees.

Occasionally, though, the voluntary process is simply too slow to satisfy the immediate needs of the Federal agencies. In those cases, ICST tries to develop a "quick fix" that will be consistent with the direction of the voluntary committees but will, at the same time, solve the worst of the agencies' problems.

An example in point is one which the Panel applauded in last year's review of ICST's activities. That is the work that ICST did with the U.S. Navy in developing document interchange specifications. We all know of horror stories about trying to use the product of one word processor with a word processor of a different make. (As an aside, I relied on an electronic office automation system in preparing this testimony rather than assuming I could find compatible word processing equipment in the various cities I have been in over the past two weeks.) If we can manage the interchange at all, we are apt to get a fifteen page paragraph with very funny locking margins. ICST worked with the Navy and a number of different vendors in developing some specifications that would solve many of the problems in effecting the interchange and the vendors have agreed to build to those specifications. This means that when the Navy procures its word processors in the future, it will not have to make a choice between being "locked into" a single vendor or putting up with the incompatibilities among products. This will save the Navy millions of dollars. Those savings will be magnified, of course, as other government agencies adopt the specifications; and the savings would be astronomic if U.S. industry should adopt the specifications.

That brings me to my request to this Subcommittee. Please broaden ICST's mandate to specifically cover work with industry ADP users. As I mentioned before, ICST works with industry as a by-product of its mandate to help Federal agencies. For all its efforts, though, ICST cannot reach much of the consumer industry and we need ICST's leadership if we are to attain the level of productivity that the new computer and communications technologies make possible.

An area of improvement that the Evaluation Panel three years ago urged upon ICST was to tell their message, i.e., what they were doing, to the non-Federal Government world. The Panel was impressed with the work going on in ICST in many areas and felt that it was important that this non-biased group publicize their message to not only State and local government but to the consumer industry as well. ICST heard that recommendation and again was applauded by the Panel for their efforts in making their work better known. They have published news bulletins, sponsored forums as well as teleconferences and have generally been more vocal in what they were doing. This "tooting of their own horn," so to speak, was a very important aspect of making their non-biased synergy work. The panel feels very strongly in this area because ICST can provide a leadership which cannot come from industry itself.

For one thing, we are too diverse to produce a common leader. For another, many are not in the ADP business and as consumers, would not have the technical expertise required for genuine leadership. And for a third, we operate under the same non-disclosure restrictions as does the computer industry. As sometimes competitors, the possibility of sharing proprietary data is non-existent. But we can and do trust ICST. A broadening of ICST's mandate would allow them to treat user-industry relations as more than a by-product of their primary mission. Any increase in the productivity of American industry as a whole will not only strengthen America's trade position but will greatly benefit the American consumer.

There is one more matter which we need to cover--namely, ICST's budget. I have noticed that in the past, this Subcommittee has asked witnesses to comment on the Institute's funding. I would like to stress that I am not as conversant with the details of this budget as I would be if I were fighting for the budget of my areas within my corporation, but I would like to make two points. The first is that with the proposed five million dollar budget, ICST simply cannot fulfill its current mandate.

If five million is all that is available, we would do better to disband ICST and thereby publicly state that the mandate is not needed rather than waste five million dollars with results that cannot be even close to acceptable. Having said that, I would expect a question from you asking what I believe might be an appropriate budget and again I would tell you I am not close to the details so I would hedge my answer by saying that as of five years ago, ICST's budget, in today's dollars, would be about fifteen million. Five years ago, it appears that that authorized funding allowed ICST to operate effectively. ICST today is much stronger because of their reputation than they were five years ago so I feel strongly that we, as taxpayers, as well as consumers, would get more bang for our bucks. Therefore, a roundabout answer to an unasked, at this point, question is that I respectfully suggest that you consider a fifteen million dollar level as appropriate for ICST's needs. With this level of funding, ICST can be held accountable for producing results that can be measured and will add to the productivity level of our government and our industries.

Thank you. I would be happy to answer any questions you might have.

February 7, 1984

Shirley F. Prutch is Vice President and General Manager of Martin Marietta Data Systems, Martin Marietta Corporation, with primary responsibility for the Martin Marietta Accounts Division. In this role, she is responsible for direction and execution of all data processing within the Martin Marietta Companies.

Starting her career with Martin Marietta as a trainee computer programmer in the Denver Aerospace Division, Mrs. Prutch advanced through programming, systems design, and technology. Leaving Martin Marietta, she was Director of Computer Services for King Resources, an oil exploration company. She subsequently assumed responsibilities as Vice President of Operations for Computer Sharing Services, a time sharing subsidiary of Rio Grande Industries. Returning to Martin Marietta as Director of Regional Technology, she became Director of Network Operations and, subsequently, Director of the Denver Aerospace Account. After a year as Executive Director of the Orlando Aerospace Account, Mrs. Prutch transferred to the Corporate Headquarters in Bethesda, Maryland in 1979.

For the past three years, she has been a member of the Evaluation Panel for the Institute for Computer Sciences and Technology of the National Bureau of Standards and is presently serving as Chairman of this Panel. Mrs. Prutch was an active member of Share, Inc., an international organization of IBM computer users, and served as President of that organization from 1974 through 1976. She has also served as Secretary to Technical Committee 2 of the International Federation of Information Processing (IFIP) from 1972 through 1974. Additionally, she has been a member of the Systems Auditability and Control Advisory Committee for the Institute of Internal Auditors. She is a member of DPMA and ACM.

Mrs. Prutch studied at Heidelberg College, Millersville College and the University of Illinois. Her undergraduate and graduate degrees are in Mathematics with additional training in English and Education. She has spoken to organizations, colleges and universities in the United States and abroad on such topics as Auditability & Control, Sales Motivation, Productivity, Personal Motivation and The Role of Women in Data Processing Management.

Mr. **Walgren**. Thank you very much. That again is, I think, the kind of testimony that is very helpful to us, as we that have to weigh the direct requests of the Administration and the difficulty of assessing what they can actually do and can't do from written testimony that often sounds very positive, but truthfully, probably is more positive than reality would have it be.

Let me go back then and just touch on a couple of points.

Dr. Steinbrugge, the 5-year plan—how does the Administration request in dollars compare to what the 5-year plan would have it do?

Dr. **Steinbrugge**. I can only answer that in part, because the information pipeline from Washington to San Francisco takes a little time. I don't have all that information.

But in the cases that I was able to look at in the last few days, it would seem to be significantly less in those instances.

I cannot speak to the total sum at this time. I do not yet have that information. One case that I did have time to look at, and since the subject is National Bureau of Standards, there it seemed clear that it was inadequate, grossly inadequate.

Mr. **Walgren**. Where is the plan presently? We understand that this plan would have been sent formally to the Congress some time ago and that after it is reviewed by apparently another panel, if that is correct, and to my knowledge, it at least hasn't been formally sent to the Congress, and I don't know exactly what our own internal resources are in knowing what the 5-year plan that has been developed really looks like.

Dr. **Steinbrugge**. I can answer that only in part and to the extent that I know, the full extent that I know, the public law which was involved in this was first looked at in some detail by a panel, the Office of Science and Technology Policy some years ago, which I headed.

Subsequently, in the implementation thereof, FEMA established a review panel, which I also currently chair. This panel is independent, and I mean by that they are zero pay, and they don't get their expense account paid very soon if at all.

But they took a look at the FEMA report which had been prepared in conjunction with the agencies and said, "This is not what the original intent of the law was," as they interpreted it, and the interpretations are the amount of effort put worth in each program.

The panel reviewed it, reorganized it on the basis of programs, so it would be sure that programs were covered, including those of the National Bureau of Standards, but did not involve themselves in the standards.

This panel's report was completed, submitted to FEMA, had a hearing, which I also testified at last year, and it was stated, and should be a matter of record there that it would be available in 90 days.

I cannot speak to its nonappearance. I might add a couple of more comments.

We had hoped that FEMA would adopt our changes, so we resubmitted it to them, hoping that they and the agencies would take it and run from there. It is better to try to convince than to come up with a report that becomes controversial, and no one does anything about it.

I hope that was the correct decision.

Mr. **Walgren**. You indicated that FEMA is getting a 50-percent increase in earthquake programs, and yet the establishment of a strong independent advisory committee and an effective earthquake branch, I gather as a separate organizational unit, is still unclear.

Is that the status of it?

Dr. **Steinbrugge**. I think that is a fair summary of it. There are indications that it will be done, but I will believe it when it is done.

Mr. **Walgren**. They have made indications that they are going to have an identifiable earthquake branch in FEMA?

Dr. **Steinbrugge**. That I thought was true in December. I have been told since that their other reorganization is taking place, and I am not sure of that.

The advisory committee, I have been reassured very recently, would be in the process, but the organizational methods involved, procedural methods, have not allowed its establishment.

The extent and the development of the earthquake office is now, if it is by that title, and I am not sure that it will be, is something that I cannot speak to, but it is of concern to the panel and to myself.

Mr. **Walgren**. I confess to some just individual frustration with FEMA in that we can always organize, and we reorganize and reorganize and reorganize, and you can never really—you feel that it is hard to evaluate the actual work product or the benefit conferred by all that effort, and they are getting a number of millions of dollars, and there are other areas that are not getting millions of dollars. Your testimony is sort of limited to that one word that somehow out of this will come leadership. What we see for that numbers of millions of dollars consumed in FEMA other than something like leadership or something like—which isn't something that you can actually eat, you know.

Dr. **Steinbrugge**. I wish I could give you a satisfactory answer. I can't, to myself. I have been working with the agencies such as the National Bureau of Standards and the National Science Foundation, Geological Survey, all these agencies interested in earthquake disaster response. An end-product user such as FEMA is vital to complete the pipeline.

Mr. **Walgren**. They are an end-product user?

Dr. **Steinbrugge**. After an earthquake, if we do not implement some of the disaster response measures which have been developed by agencies such as the National Bureau of Standards, we have lost the opportunity to save lives and property in the future. In other words, when there is destruction, we must learn from it and we must rebuild using our current state of knowledge. FEMA is directly involved in that. So the science community feels that there is a need for leadership to try to implement. After all, they do have the billions.

These other agencies have the hundreds of thousands and there is a difference there.

In FEMA's defense, I have also been close to them in seeing how they implement it in three incarnations: the Office of Energy Preparedness, the Federal Disaster Administration, and now FEMA. Each time it is a complete reorganization. If somehow the reorganizations would stop and people within it were allowed to run with the ball, I would personally be assured that we would see a far more effective coordinated earthquake program.

Mr. WALGREN. So what you look for ultimately from FEMA is implementation?

Dr. STEINBRUGGE. They have that opportunity, the opportunity to see what falls between the cracks between the National Science Foundation, and USGS. There are always problems there. Someone should look at that.

Mr. WALGREN. Someone said that the experience from the building structures in the Idaho versus the California quakes last year should be encouraging to people who are concerned about building structures. Is that true, in your anecdotal reviews?

Dr. STEINBRUGGE. In my capacity of chasing earthquakes, I have seen both of them, particularly the California Coalinga earthquake. The difference between buildings designed to be earthquake resistant and 2-story buildings you can hardly find a difference between the contractor bid and the low bid. In Coalinga, there was no question that there were earthquake-resistant buildings and the old ones were torn down. In Idaho, we had older buildings, not earthquake resistent and the public buildings such as schools suffered badly.

It would be a shame if Idaho rebuilt to the good old standards, if you know what I mean. There is a time such as now when we must do better for the future. The amount of cost for reinforcing steel between none is negligible. In a high-rise building, that is something else, but isn't there a responsibility for someone building a high-rise building which contains hundreds of people? But there the costs will be higher, but the average 1-story school, it costs nothing.

Mr. WALGREN. Where are we presently in the building code area? Are there present standards that any builder——

Dr. STEINBRUGGE. There are many earthquake standards and indeed there are. The problems arise from local—giving local jurisdictions, quite rightly so, the authority to supervise their own construction. If, however, we are considering a community where there are, let's say, a very rural community, there is very little reason to have a high degree of competence in the building department if they have one.

It is necessary then to rely on other jurisdictions. The building officials have organizations and codes that are good throughout the United States. They are separated in sections which generally are by materials of construction such as wood, concrete, and steel. Each of these sections have trade groups who do superb jobs, the American Iron and Steel Institute would have theirs, the American Concrete Institute, but each one is either materials-oriented or trade-oriented and they aren't competitive.

I was a member of the American Concrete Institute and one of their goals was to promote concrete, rightly so, so the Bureau of Standards, someplace we have to have a common intertwining of all of this. The building officials can apply it, I think the Federal

Government must do it and that is where the earthquake comes through the pipeline in the Bureau of Standards.

Mr. WALGREN. I certainly appreciate again the directness of your testimony, and let me ask Professor Stockmayer—I made a note that you were talking about the instrumentation initiatives and the upgrading of instrumentation.

Dr. STOCKMAYER. In measurement services, yes.

Mr. WALGREN. In the measurement services particular. Although we certainly recognize there is a need in that, how well are they satisfying the need in their proposals? Can you make a judgment about how adequate the initiatives in that area that they propose are to the need as such?

Dr. STOCKMAYER. Well, I can try to, Mr. Chairman. I believe the proposal in the five areas that have been selected would go fairly far toward restoring them to a forward looking position, but the five selected were taken from a list of 30, which I have here from the Bureau Director's Office, and the total sum for which could have been $13½ million as compared to the $2½ million for the five items eventually selected. So throughout the bureau there are many other areas, most of which deserve their place in the Bureau's metrology program and many other areas, which simply lost out, I guess, in some sort of selection process on which the visiting committee, as far as I am aware, has no information. At least I don't have any.

Mr. WALGREN. I see.

Were you at all able to compare what the bureau requested of OMB and what they got on the visiting committee? Does the visiting committee look at that level?

Dr. STOCKMAYER. Yes, we have. The NBS request for programmatic initiatives in toto, now, not only the measurement services—may I switch to that other level?—the total programmatic initiatives in the President's request now is $7 million. When the NBS was asked to state what from its mission and scientific point of view should be done, they came up with almost $100 million worth of ideas. The DOC request went in at over $33 million and the President's request now is $7 million, which is still, of course, extremely welcome.

Mr. WALGREN. Where did the request to eliminate the fire laboratory originate? Was that internal within the Bureau or was that imposed from above?

Dr. STOCKMAYER. Mr. Chairman, you are aware that the same request was made a year ago. However, the items were put back into the budget by the Congress. I am sure that the initiation of this proposal was not from the working groups at the Bureau of Standards. My understanding is that it came from the Office of Management and Budget, but I am not privy to the actual record of how these things developed.

Mr. WALGREN. Did the visiting board look at the Center for Fire Research on a programmatic basis or is that not the level that you——

Dr. STOCKMAYER. It is not the level at which we operate, but, amongst the evaluation panels of the Board of Assessment of which Dr. Slichter is chairman, there is one on the Buildng Research Center and one on the Fire Research Center, and I don't have copies of those in my briefcase this morning, but we always read those. I think it is fair to say, however, that not one of the present five-person visiting committee members has the expertise in this area to give testimony such as you heard from Dr. Steinbrugge.

Mr. **Walgren**. In the visiting committee's role, do you have directions in which you recommend the Bureau strengthen its programs other than dollar amounts and things like that? Are there advice or reservations that you express about the operation of the bureau that would be important to reinforce from a congressional standpoint?

Dr. **Stockmayer**. I believe that we certainly do have some useful input in that way. At our meetings, which occur twice a year, we always have the privelege to hear presentations from bureau scientists, to visit laboratories in areas that seem to be important at the time, selected with mutual agreement of the Director, staff and the visiting committee. Then, of course, we have the opportunity to comment on these presentations or talk with the individual scientists and make suggestions. At least I have had the nerve to do that a couple of times. Then, of course, we are at liberty to tell the Director at any time if we can think of anything, and that happens on an individual basis.

Finally, I would emphasize that we have, as you know, an annual meeting with the Secretary of Commerce and present to him an oral report which is followed by a written one in which the committee outlines its concerns and urges certain directions to be pursued.

I would be glad to dig out and submit any such material that the committee would find useful.

Mr. **Walgren**. I think we would certainly appreciate having access on some regular basis to that and perhaps the committee staff already has it, but we will ask the staff to ask themselves if they have it and if they don't, we certainly want and will contact you on that then. So we are the ones, I guess, who should take the initiative on that.

Well, I—again, I really appreciate the directness of the testimony, because that will be helpful for other members assessing the reservations that we had about the budget.

Let me ask Mrs. Prutch, the whole computer area, of course, is so removed from most of our levels of appreciation. If you were to try to describe the value of the Institute for Computer Sciences and Technology to an average person interested in business or in the economy, how would you do it? How would you say, "Look, this is really something that can deliver something of real value to us and therefore we should pursue it"?

Mrs. **Prutch**. I think I would probably liken it to a group of people getting together and deciding on—I am trying to stay out of computer talk now—trying to decide how—what kind of interface they might need in the way of a compatible plug to take necessary hair dryers if they were going abroad, and you would therefore know what you could take with you to make things work when the electric power, and you don't need to know anything about electric power in the European countries if you are going to Europe, but you do know that you need some sort of a plug that needs to go on the end of a hair dryer or curling iron or such in order to even make an electric coffee pot perk.

Mr. WALGREN. So if the world is to have an international computer capability, this is the real work of that institute?

Mrs. PRUTCH. I think that is one. The other thing that I believe strongly is that the institute does provide—does allow that mechanism to work that European or non-U.S. countries will not make a study by getting together and deciding what is the best way to make things happen among themselves, so that you have all the trade barriers then that go up and we as the U.S. industry cannot compete.

Mr. WALGREN. How does that trade barrier business work? Is there—I understand France, for example, at one point it was talked about they are pushing a computer capability, I believe, among their sphere of countries that identify with their culture and their political reach, and the thought was that if they really got that going, then they would be the ones that would have access to that whole market and we really won't have much access to that market. Is that—how does the work that goes on in this institute negate those kinds of possibilities?

Mrs. PRUTCH. It brings together the group of U.S. countries and policies which allow us to have the kind of clout that the people from France have, and when our people from the ICST, representatives of the U.S. Government, when they go to the various meetings where there are international studies made, they have over the past had the most clout because they had had the valued representations. So consequently it is the clout that they bring, I think, from our country as well as from their professional expertise.

Mr. WALGREN. Mr. MacKay?

Mr. MACKAY. I am sorry I have gotten here so late that I don't have any questions.

Mr. WALGREN. Let me thank all of you very much. I think your panel and presentations have been particularly helpful, and we will be able to use them to good effect, I trust.

Thank you very much.

Mr. WALGREN. The last panel today is Martin Grimes, the vice president of policy and external affairs for the National Fire Protection Association; John Bush, the chairman of the building technology executives group of the U.S. Chamber of Commerce; and Rudard Jones, the chairman of the board of the National Institute of Building Sciences.

Let me ask you to proceed in the order that I called you to the table, again with the thought that written statements and anything you would like to add will be received and made part of the formal record, and if you could focus attention on the points that you really think most interesting in the present circumstances, that would be most helpful. So Mr. Grimes, welcome to the committee. It is nice to see you again.

STATEMENTS OF MARTIN E. GRIMES, VICE PRESIDENT OF POLICY AND EXTERNAL AFFAIRS, NATIONAL FIRE PROTECTION ASSOCIATION; JOHN S. BUSH, JR., CHAIRMAN, BUILDING TECHNOLOGY EXECUTIVES GROUP, U.S. CHAMBER OF COMMERCE, AND VICE PRESIDENT, GOVERNMENTAL AFFAIRS, U.S. GYPSUM CO., ACCOMPANIED BY WILLIAM KELLAHER, MANAGER OF COMMUNITY RESOURCES, U.S. CHAMBER OF COMMERCE; AND RUDARD JONES, FAIA, CHAIRMAN OF THE BOARD, NATIONAL INSTITUTE OF BUILDING SCIENCES, ACCOMPANIED BY GENE C. BREWER, PRESIDENT

Mr. **Grimes**. No reference as to hogwash this year, sir. If you remember, that created a long discussion last year when I referred to the Administration's zero funding and its suggestion that this could be done by the private sector and the State and local government. However, I think it still applies without any further reference.

Our written submission for the record in part 3 refers to the Center for Fire Research at the National Bureau of Standards. You did ask that we comment on the other fire programs and we have done so in the first part of that statement, and unless there is anything specific on that I will concentrate on the Center for Fire Research. We were pleased to see that that is being funded and the other programs being funded and in fact increased this year.

Our concern is very much the zero funding for the Center for Fire Research. The Center, which derives its scope and its thrust from the 1974 Fire Prevention and Control Act, needs to be continued, in our opinion. In fact, it is absolutely essential that it continues, and in fact not continue in a holding pattern that it has been for the last 2 years, but go ahead. And the reasons for this, and I will be as brief as I can on this, are that we are at a point of breakthrough in fire research. This point of breakthrough is almost entirely due to the work of the Center for Fire Research, but not exclusively so, but they are the core of the work being done toward improvements in the fire situation in the United States today. They have now available to them, or technology has made available, far more efficient means of measurement, and more efficient means of analysis and modeling.

Years ago we felt that we would never be able to control or properly control what went into a building because of the multiple products in a building, the dispersal of them in the building, and their continual movement within a building and placement. Yet now with the sophisticated modeling that is available, and work being done at the Center we may be able to come up with some formula which gives us some reasonable prediction of what is going to happen with respect to the contents of the building. There is a lot of work to be done in this area and it requires a tremendous amount of cooperative effort, but I suspect that it will not be accomplished in the United States at least unless the Center for Fire Research continues its work in this area, and they will work with other organizations such as our own who are setting up a committee on this, but it is the critical part of a fire.

We talk about buildings burning down, but the contents of the buildings ignite and spread toxic gases and smoke through the building, and these are the things that kill people and render them incapable of escape.

The structure of the building is a second contributor to the situation. The design of the building and the means of egress is an important aspect, but the contents have always been the main culprit in causing people to be trapped and overcome by the gases of the fire. So that is an important program that the center is involved in.

Second, they are studying and working on the movement of smoke through buildings, and with smoke goes the toxic gases. They are looking at the possibility and believe they are moving in the right direction. Through modeling and through other analysis techniques will be able to predict the movement of the gases and the smoke through buildings. When I say predict, predict with accuracy where they will go and how long it will take them to get there, and these are very important factors to the people writing the safety codes and design of buildings, because if you can predict what is going to happen under certain conditions in buildings, you are much better able to plan the means of egress and estimate what distances of travel are required and how long it will take people to move through those or how much time people will have to move through them. So I am putting in practical terms the benefits of the research the center is undertaking and some of the major programs.

Another aspect related is the development of the quick-response sprinkler head. You may recall that in many instances of recent disasters people have said if only the building had been provided with a sprinkler system this would never have happened. That has been said even with the 100-year-old sprinkler systems. They have never been accepted as a life-safety provision per se, because it takes a lot of heat and fire to activate a sprinkler head. Once it activates it usually controls the fire.

Now with a quick-response sprinkler head that operates at lower temperature, when that operates it not only can control the fire but it also can reduce the smoke and gas and the toxic products, and it is the toxic products in the smoke and gas which has been the killer.

There is a lot to be done in this area because the performance of different sprinklers, the water requirements, the placement and different occupancies, and the relationship to the amount of toxic gas produced and its time effect on the control of the fire still has to be worked out, but the Center for Fire Research is engaged in this area. If, in fact, we can come up with a reasonably low cost, and that is part of the project, not just to develop the technique and technology but to reduce the cost of installation, it may be possible to retrofit many buildings not provided with this protection, but at the same time we may be increasing the survivability of the fire for the occupants very much.

Indicators so far are that in all the demonstrations and tests run so far that the toxic levels produced in a fire which is controlled by a quick-response sprinkler head do not reach the threshold levels to be a threat to the occupants. We hope this will go on, because we think we are on the verge of resolving many of the fire problems, and it has been brought about by the fact that the Center has assembled a good team of people that have worked in the right area, taken advantage of new technology.

For instance, we were never able to measure accurately the effect of sprinkler droplets, the size of them. In fact, years ago in Britain we were using photographic paper and measuring the sizes of the drops that caused the change in the reaction on that paper with micrometers. Now with laser equipment one can measure these accurately and fast.

So there is a lot to be done with this new technology. To talk about ending the work at the Center at this time when we are seeing progress I think is ridiculous, almost criminal. The Center for Fire Research has done a tremendous amount of work in the time that it has been operating under its new reference, that is the 1974 act. It has produced a lot of advantages that are being taken into the field and applied by the codes and standards groups. We as a codewriting body depend on this sort of research.

The other aspect you might want to consider is that if the Center does discontinue its work there is going to be a ripple effect through those researchers outside the government, the academic research areas, and that is going to dry up. If all the expertise diverts to other fields, including the Center for Fire Research, we are going to turn the clock back a long way. In fact, the United States is the only country that has very little Federal assistance to fire research compared to other countries. It puts those other countries at a tremendous advantage, and we are having to use work from other countries, but it is belated and not necessarily applicable to construction methods and differences in the United States, so the suggestion of discontinuing this program is ridiculous.

When you think of priorities for the $8 million or $10 million that should be funding this program now I wonder where we are. We are talking about a lot of money into the earthquake program and every day people are dying in fires. I do not say the earthquakes should not be funded, but the amount of money needed for fire research is negligible. Fire deaths are not in large numbers. It is not the same catastrophe as when all the buildings collapse and fire sweeps through the area, but fire is taking them away every day and a lot of them are young children. Even if you discount those that die, a lot of people are walking around with severe burns.

I went to the Shriner Burn Unit in Boston and saw people in their teens with stumps for arms and legs, with faces that look like something out of a late night horror movie. It is worth a visit to places like that to get to the seriousness of this problem. When a big hotel burns down and the media turns attention to it it is important, but every day people are dying and every day people are threatened by this. So I would suggest that priorities be reassessed and that increased attention be given to this annual appearance we have to make to support the Center for Fire Research. It is an absolutely essential part of this Nation's fire program. It is as important as any other program. In my opinion it has now become more important because of the breakthroughs that we can see coming down the road. After all, would it not be worth putting that money into resolving this problem so that by the turn of the century we could have retrofitted all those buildings?

Recently, at a hearing, a leading architect said that in the year 2000 we will still be living in 85 percent of the same buildings we are living in now. But just putting the protection in new buildings is not going to solve the problem. We are looking at the possibility of low-cost retrofitting to increase the safety of buildings that no other steps could be taken to make them safe, so why abandon this important research at this point in time. I think it is ridiculous. I think the priorities are wrong and I sincerely hope that your committee, sir, will do something about it as you did last year and hopefully not in the standstill position it was left in last year.

[The prepared statement of Mr. Grimes follows:]

STATEMENT CONCERNING THE FEDERAL FIRE PREVENTION AND CONTROL PROGRAMS

submitted to the

Subcommittee on Science, Research and Technology
Committee on Science and Technology
United States House of Representatives

by the

National Fire Protection Association
Batterymarch Park
Quincy, Massachusetts 02269

February 7, 1984

Part I

The National Fire Protection Association (NFPA) supports the reauthorization of the Fire Prevention and Control Act of 1974. In providing support for the reauthorization of this Act and the activities of the United States Fire Administration (USFA) and the National Fire Academy, the NFPA provides the following brief background concerning the Association.

The NFPA, founded in 1896, is a nonprofit, technical and educational membership organization. It has remained the principal public advocate for fire safety since its inception. The Association's membership of over 32,000 is drawn from the many disciplines involved in, and concerned about, the national fire problem. NFPA is not a trade or industry association. No one group or interest is dominant. The only common membership denominator is a concern about fire safety. Members include fire service personnel, fire marshals, electrical inspectors and city managers; architects, engineers and educators; health care facility operators and similar groups from commerce, industry, insurance and the Federal Government.

One of the principal functions of NFPA is the development of more than 200 consensus codes and standards related to fire protection. They range from the Life Safety Code through the National Electrical Code, the National Fuel Gas Code and flammable liquids standards, sprinkler and similar equipment standards to those used for fire apparatus, fire fighter safety and professional qualifications. NFPA has many other functions including public education, technical advisory services, research and development, and data collection and analysis.

The NFPA is a founding member of the Joint Council of National Fire Service Organizations (JCNFSO) which has been a prime mover in getting and sustaining a federal focus on fire.

Part II

The NFPA has provided testimony or statements for the record in support of the United States Fire Administration at all of its authorization and appropriation hearings. NFPA has been a strong supporter of the need for the United States Fire Administration and an effective federal involvement in resolving this Nation's fire problems. The NFPA would like to indicate to the Committee its support and approval for the present leadership and direction provided by the Federal Emergency Management Agency. Some of the achievements of the United States Fire Administration are:

- Development of cooperative programs which, in the intent of the enabling legislation, work with existing organizations already well established within the national fire community, taking advantage of the activities of these existing efforts and avoiding duplication.
- In recognition that fire is very much a state and local problem, by supporting and assisting state and local programs in areas for which local resources are limited, or where federal resources are the most effective way to deal with the problem.
- Maintaining the thrust, intent and purposes of the Federal Fire Prevention and Control Act of 1974.
- Placing emphasis on programs dealing with solutions to the everyday community fire problems.

- Continued and highly effective programs of the National Fire Academy and giving these programs the highest priority necessary in relation to the magnitude of the national fire problem. The Academy has always been a major priority with NFPA.

The NFPA desires to compliment FEMA on its recognition of the capabilities of ongoing programs at the state and local level, as well as within the private sector. The Federal Emergency Management Agency has initiated cost-effective, cooperative programs with state and local agencies and other organizations in the true intent of the Fire Prevention and Control Act.

NFPA is encouraged by the direction being taken by the Federal Emergency Management Agency and feels that even more involvement and usage of ongoing programs can ultimately benefit the objectives of the Fire Prevention and Control Act of 1974. As the Nation's principal public advocate for fire safety, the NFPA strongly supports the programs of the United States Fire Administration and the National Fire Academy as provided for in the FY'85 budget under consideration.

Part III

The 1974 Act amended the generic act of the National Bureau of Standards (15 USC 278) to provide for the Fire Research Center at NBS.

We wish to express very serious concern about the future of that establishment. In the Administration's budget for FY '84 there was a zero funding for the Center. Your Committee and the Appropriations Committee restored funds which finally equated the FY '83 level. This was obviously a holding pattern and NFPA greatly appreciated the support Congress gave.

However, the Administration's FY '85 Budget again shows zero funding for the Center for Fire Research and we cannot help wondering how long this fight must continue.

Congress very clearly indicated that fire research by the Center was an important part of the purposes of the Act and necessary to reduce the debilitating effect on the nation's well-being, both in terms of wealth and resources, as well as human suffering.

Since the Act was put into effect, the Center has performed admirably in the role articulated at that time.

The Center has executed many programs of research that have contributed to better control and reduction of the fire problem.

Without going into the litany of these programs, which we submitted to you last year in a lengthy paper on the Center for Fire Research, we would like to point out that scientific and technological research and development has brought means of dealing with the fire problem to us that never were available before.

I refer to the availability of new state-of-art measurement and electronic analysis, which not only enables almost every aspect of fire behavior and the reasons for its erratic and variable growth to be broken down into hitherto unidentifiable components, but also for electronic modeling to be used to provide predictions of fire occurence, growth, and the effect on materials that could eventually change the whole approach to eradication of fire as a threat by prevention and control.

The Center for Fire Research is at the core of this progress and the possibility of an abrupt end to this is not only appalling but also, in our opinion, criminal. The ripple effect on those outside the Center would be such that academic and scientific fire research work would slow down and possibly stop. The transfer of technology that also stems from the work of the Center would cease.

In an age when research and development is moving ahead in most areas, when we are beginning to see results from new technology in fire control, we fail to see the logic behind the move to eliminate fire research.

We recognize the need for restraint in Federal spending, but when we see lives being lost, hundreds of thousands of disfiguring burns, and billions of dollars of our national wealth reduced to ashes, we find it hard to accept that the 8 to 10 million dollars needed for federal fire research is not worthwhile.

In fact, both in terms of lives saved and property preserved, it is a good investment and certainly will be a cost-effective use of funds.

We have indicated that technology has brought us to the threshold of a new and meaningful attack on the fire problem; we would like to point out just a few examples of key programs of the Center that will lead to very effective solutions:

SMOKE HAZARD ASSESSMENT - This is a multi-faceted program which addresses not only the toxicity of products of combustion but also the movement of the lethal gases in buildings. The CFR work can and will, if continued, ultimately enable a prediction of the hazard in various parts of buildings, even those remote from the immediate fire, and also estimate the time it would take for the building atmosphere to become dangerous to occupants.

The significance of this might not be readily apparent to the layman, but if one recalls some recent fire disasters, it should be easily recognized how critical this information is to building designers, developers, and to code enforcers. And how much more critical it is to those whose lives might be saved by improved design and fire control measures.

FAST-ACTING SPRINKLER SYSTEMS - Over 100 years ago the sprinkler system was introduced and since has more than justified the moderate cost of installation. These systems were generally considered to be for property protection despite the fact that the life safety record in sprinklered buildings has been consistently good.

Recent changes in response time and performance of sprinklers, done mainly to create a low-cost residential system for homeowners, have indicated that the fast-response sprinkler could have a vastly increased life safety role, not only in homes, but any type of occupancy. It might perhaps be the answer to many other fire safety problems. The CFR work on the relationship of the fast-response spinkler to life safety is of vital importance to everyone.

The fact that the technology is now emerging to reduce life loss and materially reduce cost of fire protection at the same time is alone sufficient to justify the continuation of this program.

BUILDING CONTENTS CONTRIBUTION TO FIRE HAZARD - Most safety precautions in fire control have been based on the structure of buildings and in-built protective features. But in almost every fire that occurs, it is the contents of the building that initially ignite and continue to burn creating the smoke and toxic gases that trap and kill the occupants. This has been known for hundreds of years but due to the multiplicity of materials, design, placement and the daily variations that occur in the disposition of contents, it has never been considered very practical to try to cope with this other than in a limited way. With the advent of many new materials, the problem has been compounded.

The CFR is now involved in a program that is expected to lead to methodologies of measuring and modeling contents on a scale that has not been possible before. It should lead to ways of analyzing the effect of building contents when involved in fire that can be translated into practical and applicable formulae for all involved in the design and use of buildings of all categories. There is much work that needs to be done in this area and it is not going to be an easy task but the CFR is the obvious place for the initial research to be carried out.

While these three programs are not the only ones of major importance and that offer solutions, they are good examples of the direction fire research at the Center is taking. These directions are essential, realistic, and are taking full advantage of modern technology. Many of these also involve the Center for Building Technology which has an important and synergistic role with the Center for Fire Research.

We urge that every possible effort be made to preserve and continue the Center for Fire Research and to provide adequate funding for the work that is so necessary to an effective reduction in the United States fire losses.

MARTIN E. GRIMES

Martin Grimes has held the position of Vice President for Policy and External Affairs of the National Fire Protection Association since 1980. Grimes joined the staff of NFPA in late 1969 and, until 1976, headed the Public Protection Division of the Association. This Division is responsible for all services of the NFPA in the public sector of fire protection, including fire suppression, fire prevention and enforcement.

From 1976 to 1980 he was Assistant Vice President responsible for NFPA's Government Affairs activities in Washington and at state and local levels.

Grimes has been actively involved in professional fire protection activities for 40 years.

Between 1940 and 1943, Grimes served in the wartime British National Fire Service. From 1943 to 1946 he served in the Royal Marines. In 1946 Grimes returned to serve in a number of major fire departments, rising through all ranks until he was Senior Fire Protection Officer of a large metropolitan county.

In 1960, he was appointed Commissioner of Fire Services in Bermuda to reorganize the fire protection services of Bermuda. This operation involved the fire services, fire, building and electrical code development and application. Using a blend of European and American equipment, techniques, codes and standards, he successfully completed this in 1969. He was awarded the Queens Medal for Distinguished Service in 1970 in recognition of his service to the British and Commonwealth Fire Services.

Grimes graduated from the British National Fire Service Staff College with honors in 1952. He is a Fellow of the British Institution of Fire Engineers and has numerous other qualifications related to fire protection and public administration. He has received several awards for his work in fire protection, including the Fire Service Research Trust Prize 1953.

As an expert opinion witness on fire, he had been involved in cases at all jurisdictional levels, both civil and criminal. He has lectured on most aspects of fire protection at colleges, universities and national conferences, and has served on legislative and standards-making committees. He has acted as consultant to several foreign governments and has authored numerous articles and reports related to public fire protection.

Grimes is the Secretary to the National Professional Qualifications Board for the Fire Service and has administered the professional qualifications system since it was established in 1972. He served on the National Fire Academy Training and Education Committee, and was a director of IFSTA for several years. He currently serves on the Executive Committee of the Organizational Member Council of the American National Standards Institute. Grimes is also Secretary and Executive Officer of the National Fire Protection Research Foundation.

In his present position, Grimes deals with policy matters over the wide range of NFPA's activities and is also responsible for membership, conferences and general liaison of the Association. He has testified on many occasions before Congressional Committees on a wide range of matters related to fire protection and is intimately involved with the many important issues in fire protection that face the nation today.

Mr. WALGREN. Thank you. That is excellent testimony and will be of help in pursuing that particular objective.

Let me turn to Mr. Bush.

Mr. BUSH. Mr. Chairman and Mr. McKay, thank you very much for inviting us to appear here today. I wish you had not scheduled me right behind Mr. Grimes, because I think he is a rather impossible act to follow, very articulate and valuable testimony.

I would like to highlight from my prepared testimony, which you have. Accompanying me is William Kelleher, manager of community resources at the Chamber of Commerce of the United States.

My appearance today is on behalf of the chamber where I serve on the construction action council as chairman of its building technology executives group. The U.S. Chamber of Commerce is the Nation's largest business organization, with a membership of 200,000 consisting of business firms, local, State, and regional chambers of commerce, and trade and professional associations.

Mr. Chairman, the U.S. Chamber supports reauthorizations of the Center for Building Technology [CBT] and the Center for Fire Research. Continuation of both these organizations is vital to the entire construction community. They provide unique research capabilities and perspectives which cannot be duplicated in the private sector.

A good example which I cited previously last year of how valuable this center has been to the construction industry is the example of the thermal insulation standards proposed by the Federal Trade Commission 5 years ago—4 years ago. There was no way to measure the thermal efficiency of insulation to meet this standard. As a result we appealed to the Center for Building Technology to come up with a standard and test method. They did after a year produce this, and the Federal Trade Commission was willing to hold off enforcement of this new rule for a year. Without the device which the Center for Building Technology produced for our industry, the insulation industry was required or would have been required to add 15 percent more material to the thermal insulation products that we were making, which would have cost us $90 million per year, which of course would be translated of necessity into the consumer's price for the product. So if you just calculate the value of the interest on $90 million, the Center for Building Technology from a dollar and cents standpoint has endowed itself ad infinitum.

The construction industry of course is one of the Nation's largest industries. It is estimated to account for 10 percent of our gross national product, and 69 percent of our Nation's wealth consists of the facilities that have been built to support and shelter all our social, economic, and political activity. The CBT, through its field work, laboratory experiments, and analytical research, provides the basic knowledge on the properties and operations of entire buildings and various building materials, systems, and components. Without this basic knowledge, which cannot be obtained through proprietary research and development, responsible and cost-effective decisions cannot be made in construction.

This has to be the key thing. The U.S. Chamber, certainly, supports privatization of any Federal or governmental activity which effectively can be privatized, but the fact is it cannot occur here, and why? I contacted a number of directors of major private research facilities in the construction and building materials area and they all said no, it cannot be done, and the reason it cannot is that a lot of investment dollars are required in order to produce these testing devices, but then only very few of these testing devices are ever sold to anybody, and never could you charge enough to defray or reimburse the cost of the research, so it has to be something other than in the private industry or private sector because it just would not and could not be done there.

The U.S. Chamber also supports reauthorization of the Center for Fire Research. The need for the Center for Fire Research remains as valid today as when it was established in 1974. The United States continues to lead the industrial world in the number of lives lost to fires, and the increasing complexity of building materials and building contents make further research vital. CFR offers unique research facilities that deal with the highly specialized issues involved in fire research, about which Mr. Grimes just testified. It is extremely unlikely that any private-sector institution could or would step in to provide either the equipment or interdisciplinary approach needed to address this problem.

In conclusion, Mr. Chairman, the Nation faces numerous challenges in the construction industry in the next 10 years. We must house the new families emerging from the baby-boom generation, rebuild our infrastructure, and construct modern plants to restore economic vitality and provide jobs. The innovative work done by both these centers can make important contributions to meeting the technological challenges in all these areas.

We urge you to support reauthorization of the Center for Building Technology and the Center for Fire Research. They have proven records of accomplishments and offer unique facilities and perspectives that cannot be replicated by the private sector.

I thank you very, very much, Mr. Chairman.

[The prepared statement of John S. Bush, Jr. follows:]

STATEMENT ON REAUTHORIZATION OF THE CENTER FOR BUILDING TECHNOLOGY AND THE CENTER FOR FIRE RESEARCH FOR THE CHAMBER OF COMMERCE OF THE UNITED STATES, BY JOHN S. BUSH, JR.

I am John S. Bush, Jr., Vice President, Government Affairs with the U.S. Gypsum Company. Accompanying me is William D. Kelleher, Manager Community Resources Section, Chamber of Commerce of the United States. My appearance today is on behalf of the Chamber, where I serve on the Construction Action Council as Chairman of its Building Technology Executives Group. The U.S. Chamber of Commerce is the nation's largest business organization with a membership of 200,000 consisting of business firms, local, state and regional chambers of commerce, and trade and professional associations.

Mr. Chairman, the U.S. Chamber supports reauthorizations of the Center for Building Technology (CBT) and the Center for Fire Research. Continuation of both these organizations is vital to the entire construction community. They provide unique research capabilities and perspectives which cannot be duplicated in the private sector.

CENTER FOR BUILDING TECHNOLOGY

The Center for Building Technology has undertaken a wide range of activities resulting in improvements in construction technology and enhancing of the operation of the construction market place to the advantage of both industry and the consumer. Among the numerous accomplishments of the Center, I would specifically like to highlight the following:

CBT developed a method for obtaining measured calibrated transfer specimens for use in conjunction with "the representative thickness" provision of the Federal

Trade Commission (FTC) Labeling and Advertising of Home Insulation Rule. Test data and documentation were developed by CBT. This could not have been accomplished by private industry within the time limits prescribed by FTC. If the insulation industry had to comply with the FTC rule as written before the development of the guarded hot plate by CBT, increased costs for compliance, which would have been passed on to the consumer, were estimated to be $90 million per year.

Conducted comprehensive investigation of the 1981 walkway collapse in Kansas City resulting in improved design and construction procedures.

Developed performance criteria and test methods for protection of reinforcing bars in concrete salt-induced corrosion which will assist in more efficient bridge construction.

At the suggestion of the American Society for Testing and Materials and the American Association of State Highway and Transportation Officials, CBT developed test equipment and procedure so that approximately 580 public and private laboratories across the country could conduct quality assurance testing for buildings and transportation facilities.

Construction is one of the nation's largest industries. It is estimated to account for 10 percent of our Gross National Product and 69 percent of our nation's wealth consists of the facilities that have been built to support and shelter all our social, economic and political activity. The CBT, through its field work, laboratory experiments and analytical research, provides the basic knowledge on the properties and operations of entire buildings and various building materials, systems and components. Without this basic knowledge which cannot be obtained through proprietary research and development, responsible and cost effective decisions cannot be made in construction.

The construction community is a highly diverse group consisting of building owners, manufacturers, designers, financers, developers, contractors, research and testing laboratories, standards developing organizations, regulatory bodies and federal, state and local governments. The CBT is a necessary institution within this community because it provides an objective and impartial source of information and research to all those who design, finance, build, operate and use our facilities.

THE CENTER FOR FIRE RESEARCH

The need for the Center for Fire Research remains as valid today as when it was established in 1974. The United States continues to lead the industrial world in the number of lives lost to fires and the increasing complexity of building materials and building contents make further research vital. CFR offers unique research facilities that deal with the highly specialized issues involved in fire research. It is extremely unlikely that any private sector institution could or would step in to provide either the equipment or interdisciplinary approach needed to address this problem.

Specific examples of the contributions by the Center follow.

The National Bureau of Standards (NBS) Center for Fire Research (CFR) has been the guiding force in the development of testing equipment to quantify characteristics of materials which have been subject to fire. Once these characteristics have been quantified, a user of a material could rank order materials associated with the use of various products. Specific examples of standards researched by CFR in this area are:

ASTM Standard E 136 is a frequently used standard to describe combustibility of materials. The furnace used for this evaluation was developed by NBS/CFR.

ASTM Standard E 662 is used to describe the smoke-producing characteristics of a building material. This equipment was developed by NBS/CFR.

ASTM Standard E 162 and E 648 are used to describe flame spread characteristics of building material. Again, NBS/CFR led in the development of the equipment to evaluate these characteristics.

CFR has developed a major program for fire protection methods in high-rise buildings which are vitally needed in light of the MGM Grand Hotel fire in Las Vegas. Specific work has been and is being done on sprinklers, smoke control, smoke detection and building design.

The Center is the principal laboratory for the development of new test methods for flame spread and heat release which are necessary to cope with the very different burning behavior of plastics and other materials.

CFR is the major developer of computer-based fire simulation models needed to estimate the impact of new materials and methods subject to fires.

NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP)

While not part of this authorization bill, we also want to express our continued support for the National Voluntary Laboratory Accreditation Program (NVLAP). An efficient and effective system of testing laboratories is necessay for the practical application of improvement product standards. We urge you to support adequate funding for the NVLAP program so that the knowledge produced by organizations, such as the Center for Building Technology and the Center for Fire Research, can be used in the field.

CONCLUSION

The nation faces numerous challenges in the construction industry in the next ten years. We must house the new families emerging from the baby-boom generation, rebuild our infrastructure and construct modern plants to restore economic vitality and provide jobs. The innovative work done by both these Centers can make important contributions to meeting the technological challenges in all these areas.

We urge you to support reauthorization of the Center for Building Technology and the Center for Fire Research. They have proven records of accomplishments and offer unique facilities and perspectives that cannot be replicated by the private sector.

Mr. WALGREN. Thank you very much, Mr. Bush, for that testimony. It is very helpful.

And then, Mr. Jones, welcome to the committee.

Mr. JONES. With your permission, Mr. Chairman, I will read this brief statement which has been submitted to you prior.

Mr. Chairman, members of the subcommittee, my name is Rudard A. Jones. I am the Chairman of the Board of Directors of the National Institute of Building Sciences [NIBS] and professor emeritus in the Department of Architecture with the University of Illinois at Urbana. Formerly, I directed the University of Illinois' Small Homes Council—Building Research Council. With me is Gene C. Brewer, president of the Institute.

I had the privilege of addressing this subcommittee a year ago on how the building community felt about the programs and projects under way within the Centers for Building Technology and Fire Research. At that time we provided the subcommittee with a position paper—this was dated February 17, 1983—stating the NIBS position in opposition to the proposed fiscal year 1984 termination of appropriated funds for the two research centers. A copy of this 1983 position statement is herewith submitted for your review and recollection. Our position today is no different.

Other witnesses have provided the subcommittee with lists of reasons for the continuation of these two centers. It is certainly true that both CBT and CFR have unique facilities for testing and evaluating materials and systems, facilities that are found nowhere else in the United States. If these centers are eliminated, the United States would lose a key building research laboratory and a major nonproprietary source of technical information used for the development of voluntary standards by organizations concerned with the safety and performance of building components. This would be a significant loss to the building community and to the Nation.

Today I want to reemphasize that there are certain kinds of building research that are most appropriately done under the aegis of Federal Government. Characteristically such projects involve many sectors of the building community, or large specialized equipments and personnel, or both. These factors usually cause private industry to bypass this kind of research, and therefore it is necessary for CBT and CFR to stop in. Very often this research is fundamental to the understanding of building behavior. One such program that I find encouraging is the experimental work to develop evaluation criteria for assessing the effect of thermal mass on the heating and cooling loads and energy consumption in buildings. This research is yielding new information on the effect of thermal mass in the overall thermal performance of large buildings. Soon such data may be used to validate computer models which attempt to simulate heat flow and energy utilization within buildings. Many private sector standardsmaking organizations are awaiting these research results in order to consider revision of current standards as appropriate, as more sophisticated data and information becomes available.

You may recall that last year before this subcommittee NIBS expressed a strong interest in developing a formal arrangement between NIBS and NBS which would assure continuing input of the building community, via NIBS, to the program of NBS. The institute was pleased with the actions of the subcommittee in recommending continuation of funds for CBT and CFR last year and we were also pleased with the leadership exercised by Representatives Walgren and MacKay in seeing that a formal exchange of views on building technology was institutionalized between NBS and NIBS. On October 18, 1983, a memorandum of understanding was executed by the Director of NBS and the Chairman of the NIBS Board. This MOU calls for the following:

First. NIBS annually will provide NBS with a priority list of building community research needs;

Second. NBS will consider the NIBS priority lists and other recommendations in formulating the NBS building technology and related fire research programs;

Third. NBS annually will inform NIBS of its building technology and related fire research programs;

Fourth. NBS will provide reports on its completed building technology and related fire research programs to NIBS;

Fifth. NIBS will provide recommendations to affected organizations for implementation and use of NBS building technology and related fire research results as deemed appropriate; and

Sixth. NBS will provide presentations on its building technology and related fire research programs to the NIBS Board of Directors and the NIBS consultative council as is useful and appropriate.

At the present time NIBS through its consultative council is actively engaged in developing recommendations for needed research and we are prepared to strengthen the two-way communication between NBS and NIBS in any way possible.

Mr. Chairman, I appreciate the opportunity to appear before you again this year. To sum up the NIBS attitude, we are opposed to the elimination of the budget item for the NBS-CBT and NBS-CFR. The elimination of either of these agencies would be a disservice to the public and would not be in the Nation's interest.

Thank you very much for giving me this opportunity to appear.

[The prepared statement of Mr. Jones follows:]

A. STATEMENT BY RUDARD A. JONES, FAIA, ON BEHALF OF THE NATIONAL INSTITUTE OF BUILDING SCIENCES ON THE CENTER FOR BUILDING TECHNOLOGY AND CENTER FOR FIRE RESEARCH AT THE NATIONAL BUREAU OF STANDARDS

Mr. Chairman, members of the Subcommittee, my name is Rudard A. Jones, FAIA. I am the Chairman of the Board of Directors of the National Institute of Building Sciences (NIBS) and professor emeritus in the Department of Architecture with the University of Illinois at Urbana. Formerly, I directed the University of Illinois' Small Homes Council—Building Research Council. With me is Gene C. Brewer, President of the Institute.

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At the present time NIBS through its Consultative Council is actively engaged in developing recommendations for needed research and we are prepared to strengthen the two-way communication between NBS and NIBS in anyway possible.

Mr. Chairman, I appreciate the opportunity to appear before you again this year. To sum up the NIBS attitude, we are opposed to the elimination of the budget item for the NBS-CBT and NBS-CFR. The elimination of either of these agencies would be a disservice to the public and would not be in the nation's interest.

POSITION OF THE NATIONAL INSTITUTE OF BUILDING SCIENCES (NIBS) REGARDING THE FY 1984 BUDGETS OF THE CENTER FOR BUILDING TECHNOLOGY AND CENTER FOR FIRE RESEARCH

The Department of Commerce has proposed the complete phasing out of the Center for Building Technology (CBT) and the Center for Fire Research (CFR) within the National Bureau of Standards. The National Institute of Building Sciences believes that elimination of these centers would not be wise; rather, the missions and scope of activities of CBT and CFR should be carefully evaluated with respect to the legitimate concerns of the building community.

The United States government already spends less per capita on building research than governments of other developed nations. Less is spent by the Federal government on research in building than in most other industries, despite the fact that construction represents a significant proportion of the Gross National Product and that almost 70% of the nation's wealth is represented by the value of constructed facilities. Of even greater importance is the fact that the fragmented nature of the construction industry makes it extremely difficult for the industry to conduct basic research. Indeed, such research will not be accomplished in the absence of a Federal effort. It is this research that can have meaningful impact on reducing life and property losses due to fire in a nation which leads the world in fire loss, help promote innovative technology, and help prevent deterioration of the infrastructure of our built environment.

Therefore, NIBS urges that CBT and CFR be continued with a sufficient budget to carry out their respective basic research missions. It does so with the caveat that provisions be made for greater industry involvement in the determination of CBT and CFR programs and in the review of the quality and utility of their work, and that these provisions do not involve compliance with the Advisory Committee Act.

The Congress of the United States, in passing Public Law 93-383 in 1974, found that there was need for an authoritative national source to advise both the public and private sectors of the economy with respect to the use of building science and technology. The Congress then established the National Institute of Building Sciences (NIBS) to be that source and called upon NIBS "to assign and delegate—to the maximum extent possible—responsibility for conducting needed activities . . . to one more of the private organizations, institutions, agencies, and Federal or other governmental entities with a capacity to exercise or contribute to the exercise of such responsibility, monitor the performance achieved through assignment and delegation, and, when deemed necessary, reassign and delegate such responsibility."

In recognition of this charge, the Congress should call upon and provide adequate funds for the National Institute of Building Sciences to evaluate the missions and current programs of CBT and CFR with respect to the research needs of the building community and to make recommendations to the Secretary of Commerce and the Congress as to an appropriate research agenda for these centers.

Mr. WALGREN. Thank you very much, Mr. Jones. We certainly appreciate that direct statement. Let me in the interest of time turn to Mr. MacKay, who has another commitment that he will have to meet.

Mr. MacKay.

Mr. MACKAY. Thank you, Mr. Chairman. I do apologize for the scheduling problem.

I am interested in following up on last year's conversations. I see NIBS as a potential focal point for the highly fragmented construction industry to make its input in an organized and effective way into NBS in the setting of priorities and also the evaluation of what is going on. I would just appreciate, Mr. Jones and Mr. Brewer, making any comments that you would care to make. Do you feel that we are now getting coordinated properly and that this issue is being dealt with, and also Mr. Bush and Mr. Grimes, you may also have an input. It seemed to me that last year we had indications that NIBS needed to get its act together better and that clearly there needed to be better communications, so I am interested first in your evaluation of is the system working well, and is there anything else that Congress needs to do to try to strengthen this relationship?

Mr. JONES. Well, as I indicated here, we have a memorandum of understanding now, and we are now in the process of actually negotiating how we are going to carry this out. And I believe that the thing is moving properly now, and I have great hopes for this taking place.

Mr. MACKAY. I might say, we met with the persons in the NBS who are on the other side of the issue from you, and I felt that they are acting in good faith and very constructively, and I am very pleased that that is happening.

We would see the first set of priorities and the reaction to that I guess a year from now as we get into the cycle; is that correct?

Mr. JONES. Well, the consultative council has initiated a study now, and are bringing in all these various fragments to give them the opportunity to make the suggestions on the research program. And I am not sure what the schedule is on that.

Mr. BREWER. This is just the beginning of a long process and we have lots of people interested and many good ideas, and we are sorting those out now in preparation for submitting those to the bureau, which will be done very shortly.

Mr. MACKAY. All right. Very good. I am very encouraged by that.

Mr. Bush, you get a slightly different perspective, speaking for the chamber, and yet involved in the construction industry. I am sure you are aware of NIBS and the reason it was organized and so forth. In your opinion now that this is beginning to work does this represent the best way to be going? Congress kind of set it up and in effect blessed it saying this is the best way for the industry to get its act together and tell Government where the priorities should be. Would you care to comment on that?

Mr. BUSH. Well, the founding meetings of NIBS were conducted at the U.S. Chamber of Commerce. We have strongly supported NIBS for a period of approximately 20 years, although they have only been in existence about 8 years. We petitioned the Congress in behalf of NIBS.

Mr. MACKAY. So it really is sort of a brainchild?

Mr. BUSH. It has many fathers, but we are certainly one of them.

Mr. MACKAY. Not to suggest that it is illegitimate, but——

Mr. BUSH. No. It was a joint effort. We do have as in so many areas problems of getting adequate funds to NIBS to operate, and we are working with Mr. Boland now on appropriations and certainly would appreciate any support you could give us on that in adequate funding for NIBS, which is a matching funding between private gifts and endowments, and then the public matching money.

Mr. MACKAY. It would seem to me that with the administration taking the position it is taking there is going to be increasing pressure for the public-private approach to funding. In effect the public sector is saying to the private sector, you have got to put your money where your mouth is.

Mr. **Bush.** That is right.

Mr. **MacKay.** I would hope that maybe by increasing the efficiency of the coordination we could make a better case that this would be a good expenditure for the private sector, particularly in the area of building suppliers and so forth, the need to develop standards.

Mr. **Bush.** They are vital, they certainly are, to our success.

Mr. **MacKay.** I just have one other question. You have talked about the experimental work to develop criteria for assessing the effect of thermal mass, and cooling loads and energy consumption in buildings. That is a great sounding sentence that I do not understand. What is the exact problem that we are talking about?

Mr. **Jones.** Well, historically over many years, of course, our residential construction is primarily wood frame construction, which is lightweight construction, and most of the calculations we make on heat loss and so forth are based on theories of almost instantaneous change due to temperature change outside. It is well-known that mass, heavy massive structures, react in a different way, but this has never been too critical of a problem until our recent concern with energy consumption. So now we are trying to find out just how we can best represent this in some of our calculations for heat loss and so on.

Mr. **MacKay.** I see.

Mr. **Jones.** And this has to be verified by experimentation to see how it works out.

Mr. **MacKay.** Mr. Chairman, I might ask one other question. I heard a very thought-provoking radio essay and exploration of the technology that is being used in Japan in the production of housing as contrasted to the United States, in which the Japanese had basically gone forward with true computerized factory-built housing, and the discussion there seemed to indicate that there were massive, phenomenal potential savings in America if we would go forward with this, either licensed from the Japanese or else on our own.

Do you see this as an area that NIBS should be involved with? One of the things that reminded me of that, they have developed an interior substance, I have forgotten the name of it, for walls, which apparently is much lighter and yet has sound insulation and thermal insulation characteristics that are favorable as compared to materials used in this country.

Mr. **Jones.** I am not acquainted with the product involved there. I will say, though, that the Japanese live differently than we do, and they accept things that we would not accept in terms of sound transmission and so forth. So that would affect housing acceptance in this country.

Mr. **MacKay.** I just—I am curious, though, about the basic question. They are now building homes on assembly plant methods using robots and computer cutting of materials and have sort of abandoned hammers and saws, and although we build houses in factories, we apparently, still build them with hammers and saws and techniques that involve thousands of dollars per home that could be saved, and I wonder if NBS and NIBS should not be a focal point for saying to the industry, maybe the world has changed. I am just curious about that.

Mr. JONES. Well, I think that we could examine these sort of things and go ahead. One of our programs has to do with better methods and improved methods of product certification and acceptance, and that type of thing would have to go through that sort of approval, and right now there are a lot of roadblocks in that area. And then I also have to confess that personally I think there is a lot of market resistance to housing of a repetitive type. We find that even in this country.

Mr. MACKAY. According to this essay, and that is the sum total of my knowledge, it was about a 15-minute presentation, there is greater variety available under their system than there is under ours.

Mr. JONES. Interesting.

Mr. BREWER. Mr. MacKay, that Japanese situation has attracted a lot of attention. In fact, the National Association of Homebuilders have sent a couple of missions over there. In fact, I saw a presentation by one of my leading builders, Ryan Homes in Pittsburgh. They had an excellent slide presentation and it does open your eyes. The Japanese aren't doing anything that we can't do. We have some barriers to overcome, however.

Mr. MACKAY. My question is, is that not an appropriate function for both NIBS and NBS, not to be testing what is there now, but to be considering other places where the state-of-the-art has advanced by order of magnitude? Of the U.S. Chamber of Commerce I would ask that question also—should we not be trying to put forward the state-of-the-art, particularly if it might mean a savings of—they were talking about $20,000 to $30,000 on a $100,000 home.

Mr. BUSH. It certainly was our intention and I believe is part of the charter of NIBS and they are very conscientious in trying to fulfill their charter to find new technologies to reduce the price or increase the quality of our built community. Exactly what you are suggesting, Mr. MacKay, is totally appropriate, in fact, I think it is in the charter of the organization.

Mr. MACKAY. Mr. Chairman—If we could do so, it would be very interesting perhaps to set up a hearing and ask the Ryan people or others who have visited the Japanese and have presentations of that type to see if this committee might not be a focal point for that.

Mr. BUSH. We could help on that. I attended the week-long annual convention of the National Association of Homebuilders in Houston 2 weeks ago. There was a huge delegation of Japanese who were on an exchange visit for the large delegations of Americans who have gone over there. I think the home builders could help you set that up because these are their members, but they are looking at this very carefully.

Mr. WALGREN. We would be interested and let's talk about how we might be able to do that and we will certainly take you up on your offer.

Mr. BUSH. As a matter of fact, I am going to invite you to come speak to the home builders on the 5th of March, but I will do that after the hearing is over.

Mr. MacKay. I say both to NBS and to NIBS, I appreciate the constructive and cooperative effort that has been made, and I think frankly just that little nudge that this subcommittee may have given has things functioning more in accordance with what it was originally intended to do and I apologize for having to leave.

Thank you.

Mr. Walgren. Thank you, Mr. MacKay.

Well, let me just pursue a couple of thoughts.

Mr. Bush, you mentioned the difficulty of privatizing testing devices that I gather are not used all that frequently. Can you give me any more facts around that idea than just those words?

Mr. Bush. There are on pages 2 and 4 of our testimony examples, further examples of ASTM testing where both centers develop the instrumentation for it and, as I say, my understanding from our vice president of research, who has been very involved in NIBS—not NIBS, I mean the Center for Building Technology, and from other similar private industry research people, that the amount of cost of research that goes into relatively few devices which end up being produced might just be half a dozen devices across the whole United States, which would be used in different testing centers and result in the private contractors coming in to pay to have their products tested. It would not be possible to sell these testing devices for a price which would reimburse you for the cost of research and there are several examples here.

If we could make this more clear, we would be happy to submit something further, Mr. Walgren.

Mr. Walgren. Well, if somebody does have a crystallization of that thought and a real concrete example, I think it would certainly be helpful to the record.

Mr. Grimes, you mentioned that the Fire Research Center was in somewhat of a holding pattern this last year, I guess for this period of time, when they have been not supported by the administration at least in spirit. How does that affect their operation? You know, from here it is a little hard to know exactly how they are operating out there, what exactly they are doing and the frequency and the use of the facility.

When you mention holding pattern, how do you see that?

Mr. Grimes. I see it whereas they continue the work they were doing, and they have done it, they were not able to take that into the next stage that probably should have been done on some of those programs. There are some other programs that would have probably been desirable to start and succession of other work that is done. One comes to our mind particularly, for many years the Center for Fire Research worked on the ignition of materials by cigarettes, bedding and furnishings. Now the emphasis has switched because there is a voluntary program by the upholstery industry to sell only materials which have a reasonable degree of fire retardancy, but the death from cigarettes constitute 32 percent of deaths from fire.

We would like to have seen that work carry on now into probably another 2 years of work whereby they come up with the criteria by which a safe cigarette could be evaluated. In other words, cigarettes could be evaluated for their ignition capability. That is one program that comes to mind in light of developments over the past year or so where it has become increasingly evident that the cigarette is the prime cause of death from fire in the home. There was no growth, that meant that they were working continuing the existing program. They are at a point now when I think we are near a breakthrough and I think a little more increased effort in some of those directions may take us to that breakthrough.

If we go on at the same level of funding, it will go on and I don't doubt that the breakthrough will occur, but we would like to see it accelerated because we feel the breakthrough can come about. We have committees that write codes and standards. They need now better analytical capability. Most of our decisions regarding the safety standards which go into the fire and building codes are based on a consensus of the people who are affected by the standards and the engineering judgment of the experts that serve on those committees. Today there is capability for being much more accurate in the decisions being made and much more accurate in the predictions of what will happen, and this is provided by scientific analysis and modeling and things like that. This is what the center could now be providing those committees.

In the area of toxicity is one particular area.

Mr. **Walgren**. Does your organization carry out any of the actual research in any other format or are you simply users?

Mr. **Grimes**. We are users and also transferers, increasingly becoming a transferer of the results of this sort of work.

Mr. **Walgren**. Does your organization, in a disciplined way, set out what needs to be done? In other words, do we have requests for pursuit of a certain avenue of research that the Bureau is not able to develop?

Mr. **Grimes** I can't give you one off the head, but I will certainly when I go back look at all the different disciplines within our organization that are looking for information and compare them with what is available and send you some information on that. I would very much like to do that.

Mr. **Walgren**. Do you ever hear anything about how responsive the Center for Fire and Research is to what the rest of the community interested in this area wants done?

Mr. **Grimes**. Yes. We do hear about that and we are close to it, and I would like to say that, at the moment, the center is very responsive to the perceived needs of the people in the field. In fact, I think it was 10 years ago or 12 years ago, I testified that the work being done was not responsive to the needs in the field. I can tell you now from my own knowledge and from the conversations I have had with other people in the last few days that almost everybody perceives the work of the Center for Fire Research to be in direct response to the current needs.

I can say that without any hesitation.

Mr. **Walgren**. I see. You mentioned that the 1974 Fire Prevention Control Act, and, as I understand it, the commission that did the report in 1974 really asked for a substantially greater dollar commitment on the part of the Federal Government, but we are spending $60 million in earthquake prevention and only $15 million or thereabouts in fire prevention and I think your point about the losses is so well taken. What did we envision doing in 1974 with the increased amounts of money that were anticipated? I believe that they talked in terms of spending rates of $150 million a year as a reasonable investment in fire prevention and control, and here, 10 years later, we are at $15 million—what would they have wanted to do with those resources?

Mr. **Grimes**. Well, if you may recall, the report "America Burning," issued by the commission that was established in 1971 and reported out at the end of 1972, beginning of 1973—yes, 1973—outlined what was perceived by the commission as the priorities to deal with the fire problem, which in fact is costing the country billions of dollars in direct losses and many millions in indirect losses and many millions in providing fire departments and other protection all the time. The priorities were basically in the area of increasing the research into fire, finding the answers to the problems, which is the work of the Center for Fire Research, of course, and FEMA as well because FEMA does some research, to increase the awareness of the public. In almost all fires, there is a human element, a failure of human behavior in some way even if it is a failure in the design through lack of understanding of something but to increase the awareness and increase the technical competency of the people involved by establishing a national fire academy, making programs available to those not directly in the fire disciplines such as architects and engineers who are doing the design work and installation work and increasing their knowledge of the whole problem.

It was intended that all that money go into basically improving the state of art. It was not like in the LEAA program, more fire engines, more squad cars, more hoses. It was intended for the way it should be going now, in improvement of our knowledge, our understanding and our ability to deal with the problem through technical and scientific research and the transfer of existing technologies.

Mr. **Walgren**. Do you think it could have taken that amount of money reasonably?

Mr. **Grimes**. I think it could have been justified to use that amount of money. I think if we had that amount, we would have answers to problems today that we are still groping for. However, the parallel state of the art in the introduction of laser measurement and the more efficient modeling that you can do with computers than 10 years ago, I think that has grown at the same time, but yes, I think it would have been justified.

I think the figure in the authorization bill was about $54 million for the first year, but budgeted at $9 million and it has never gone much over $15 million this year. With the additional, it will come up to $20 million, excluding the money for the Center for Fire Research.

Mr. **Walgren**. Why do you think earthquake drew so much money instead of fire?

Mr. **Grimes**. I wouldn't hazard a guess. The effect of earthquake is something people fear. We have never been successful at making people worry about fire. We worry about crime on the streets and people worry about taking a walk at night, but we still have never been successful of getting everybody aware of fire and yet that threat is as great as others. We have some success in getting people aware of what to do in case of fire—the TV spots with Dick Van

Dyke. The survivors from the MGM fire said we knew what to do, get down and crawl and get away from the smoke; we have never acquired a fear about fire in the way that people worry about whether California is going to float into the Pacific or not.

You can frighten people and show them photographs of people that have been badly burned, but it doesn't have that mass impact as an earthquake. I don't know what it is, but it is there.

Mr. **Walgren**. I see. What do you feel should be the next step for the fast-acting residential sprinkler program?

Mr. **Grimes**. The next step would be to—we now have a standard for the application in the home, and the next step is to take that into other occupancies and also keep looking at how economical that can be made because right now, with the use of synthetic piping materials, the cost is being reduced considerably and it is now possible to have do-it-yourself kits for it.

Mr. **Walgren**. Are they on the market?

Mr. **Grimes**. They are coming on the market now, yes.

Mr. **Walgren**. What would they cost?

Mr. **Grimes**. I think the do-it-yourself kit costs about $1,000. If you install a sprinkler as part of the building, the cost would come over $2,000 at the moment, but still possible now to cut that cost down. The installation costs are much cheaper. I know that retrofit of a sprinkler system today using synthetic materials in a hotel doesn't come out much cheaper, but what it saves is time.

I know of a hotel being retrofitted where it would have taken them 6 weeks to do the job under the old way but now they can do that in 10 days using the new method, so you are saving in labor costs, and that might not be attractive to the unions that build buildings, but it will be attractive to the person building the building.

Mr. **Walgren**. Does staff have any questions? Ms. Bach?

Ms. **Bach**. You have aroused my curiosity as to why earthquake funding has gone up as opposed to fire. What are your thoughts on controlability of a fire versus the lack of control that a human has on a earthquake? I wonder if it is not that one can control their behavior and in effect reduce or minimize or prevent fires as opposed to our fear of the unknown?

Mr. **Grimes**. It could be that people don't consider fire to be the threat because they feel that they have some control over it. Don't think that I am criticizing them in spending money on earthquakes. I just feel that the priorities are a little more as far as the fire research. People do fear the unknown—that may be true. We are about to produce a film which will enhance the public's awareness that being trapped in a fire is about as frightening as being in an earthquake, because if you have ever been trapped in a fire and if you talk to people who have been trapped in a fire, the sense of isolation and peril once they realize they can't get out of that building is acute and it is a long process, it isn't 30 seconds of shaking—you can be trapped for 15 minutes and it seems like 10 hours.

You can hear nothing but the sound of the fire. Nobody has ever described that. We will have a film giving that in about 6 months which is, I think, going to have a tremendous impact in that. We are not trying to put fear of the unknown into people, but being trapped in a fire is extremely frightening.

Hollywood doesn't paint a fire as being something that you are trapped in and you die. It paints a fire as a lot of flames that people run in and out of rescuing people and valuables. It is dense, thick smoke that chokes you and causes you to cough, you can't see, you get searing pains in your lungs and if you are trapped, you are isolated by sort of a sound wall that the smoke creates. It is like being in a prison almost and it seems to be getting in on you all the time. People don't realize that fire is like that.

Mr. **Walgren**. This committee had what I thought to be gripping testimony by one fellow who was in the MGM fire who happened to come from Pittsburgh. We ought to send you copies of that testimony just for your purposes.

Mr. **Grimes**. I think we have it.

Ms. **Bach**. Would that film be available for public viewing?

Mr. **Grimes**. Yes. It is in production right now. It is going to show to the general public how a fire behaves. People don't realize that a fire starts producing gases at a temperature when the room heats to 250 °C, almost everything in the room starts to burn and that is when the fire changes from a slow growth with the gases to a sudden hot fire which in turn pumps the gases into the rest of the building and also spreads the fire. People don't understand that.

We have had great difficulty getting it over. We hope the film will show it.

Ms. **Bach**. With regard to the low-cost retrofitting for sprinkler systems, where would a homeowner get that information?

Mr. **Grimes**. In almost every telephone directory in the yellow pages, you will see suppliers of fire protection equipment and the sprinkler companies are listed under that. Publicity about their availability, I haven't seen much of that yet. That is a new thing that is just emerging. We do know of one test done recently in Ohio where three untrained people were given one of these kits and a house to install it, a house which was due for demolition and they put it in in 1 day working together, following the instructions of the kit and then the following day they set the fires in the house and it worked successfully.

This was not a scientific test, just a demonstration that untrained people could put one in and that it works afterward. I presume the manufacturers of these will start publicizing these in due course. Certainly we have a study available now that people can use to make sure it goes in and performs.

Ms. **Bach**. Would there be any costs associated with not just inserting or putting the retrofit project in, but in terms of costs for additional water costs for homeowners?

Mr. **Grimes**. Yes, in some areas you change the status of your water bills and water taxes. In fact, in some areas you may not even be able to do it yet because of the law that prohibits that type of hookup to the domestic water supply or the supply of the city. These are being looked at generally where they occur, but I think down the road—in some areas you can't connect a sprinkler system without an elaborate system to prevent contaminated water getting back into the town supply, which is right and proper, and some places are applying that to domestic systems, which makes it prohibitive.

Ms. BACH. Mr. Jones, with your referral to the thermal mass program and energy consumption effort, is that work being coordinated with the Department of Energy to your knowledge?

Mr. JONES. Yes, I think it is. I am not sure, but I think it is.

Ms. BACH. With the Memorandum of Understanding that was signed on October 18, 1983, was there any discussion at that time as to the possibility of zeroing out again of the facility, the Center of Building Technology? Was there any discussion of the Memorandum of Understanding between the Bureau and NIBS? Was there any referral to a possible zeroing out of the funding at that time?

Mr. JONES. No, not to my knowledge.

Ms. BACH. Thank you, Mr. Chairman.

Mr. WALGREN. Thank you very much.

Well, on behalf of the committee, we appreciate all that went into your coming today and the views you have given us. They will certainly help the committee a great deal in doing the right thing in this area.

I would also just like to make part of the record, with unanimous consent, testimony of the National Conference of States on Building Codes and Standards submitted to the committee in writing. And with that, that concludes the hearing.

Thank you very much.

[Material referred to follows:]

NCS BCS

National Conference of States on Building Codes and Standards, Inc.
481 Carlisle Drive, Herndon, Virginia 22070 (703) 437-0100

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EXECUTIVE DIRECTOR
ROBERT C. WIBLE

February 7, 1984

The Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research and Technology
Committee on Science and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Congressman Walgren:

The National Conference of States on Building Codes and Standards, Inc. (NCSBCS) is an organization founded in 1967 to nationally coordinate the building code and public safety interests of the nation's fifty states and several territories. The voting membership of the Conference is comprised of one governor-appointed delegate from each of the states and three U.S. territories.

The Conference learned last week that as in FY 1984, the FY 1985 budget proposal would terminate funding for the Center for Building Technology and the Center for Fire Research of the National Bureau of Standards (NBS). The Conference is gravely concerned over this matter and, therefore, we are submitting along with this letter a set of written testimony which expresses why we strongly believe that the continued funding for the Center for Building Technology and the Center for Fire Research is clearly within the national interest and well within the scope of President Reagan's "New Federalism."

The Conference appreciates your and your Subcommittee's review of our testimony. Should you or any members of your Committee or staff have any questions concerning this document, or if we can provide you with any additional information, please do not hesitate to contact me at 703-437-0100.

Sincerely,

Robert C. Wible

Robert C. Wible
Executive Director

cc: Richard Geltman, Staff Director, Committee on Community & Economic Development, NGA
Nolan Jones, Staff Director, Committee on Criminal Justice & Public Protection, NGA
Richard E. Wolfe, President, NCSBCS
Members of NCSBCS Board of Directors

Before the
U.S. House of Representatives
Subcommittee on Science Research and Technology
of the
Committee on Science and Technology

In the Matter of:

Fiscal Year 1985 Budget Proposal)
Funding for the National Bureau)
of Standards' Center for)
Building Technology and Center)
for Fire Research)

Written Testimony of the NATIONAL CONFERENCE OF STATES ON BUILDING CODES AND STANDARDS, INC.

By: Robert C. Wible
Executive Director
National Conference of States
on Building Codes & Standards, Inc.
481 Carlisle Drive
Herndon, Virginia 22070

February 7, 1984

Before the
U.S. House of Representatives
Subcommittee on Science Research and Technology
of the
Committee on Science and Technology

In the Matter of:

Fiscal Year 1985 Budget Proposal)
Funding for the National Bureau)
of Standards' Center for)
Building Technology and Center)
for Fire Research)

SUMMARY
Written Testimony of the NATIONAL CONFERENCE OF STATES ON BUILDING CODES AND STANDARDS, INC.

Regarding the proposed fiscal year 1985 zero funding for the National Bureau of Standards' Center for Building Technology and Center for Fire Research, the National Conference of States on Building Codes and Standards, Inc. (NCSBCS) finds:

1) The National Bureau of Standards' Center for Building Technology and Center for Fire Research currently provide the nation's states and local governments with invaluable building and technology research, which the state and local governments depend upon to help them adopt and enforce modern building and fire codes which provide for their public's health and life safety in new and existing buildings.

2) That the states individually or working together cannot and will not be able to build, staff, and fund or contract for such research should the Centers for Building Technology and Fire Research cease to operate.

3) That even if the states were able to build, staff, and fund or contract for such research, each state would probably duplicate the research programs of the other states in the area of building and fire safety, resulting in a potentially large waste of taxpayers' funds.

Based upon these findings, NCSBCS concludes:

That the centralization of research in building technology and fire safety at the Federal level is a proper and fiscally responsible role for the Federal government and as such, the National Bureau of Standards' Center for Building Technology and Center for Fire Research should continue to be funded as they have been in recent years.

Before the
U.S. House of Representatives
Subcommittee on Science Research and Technology
of the
Committee on Science and Technology

In the Matter of:

Fiscal Year 1985 Budget Proposal)
Funding for the National Bureau)
of Standards' Center for)
Building Technology and Center)
for Fire Research)

Written Testimony
of the
NATIONAL CONFERENCE OF STATES ON BUILDING CODES AND STANDARDS, INC.

The National Conference of States on Building Codes and Standards, Inc. (NCSBCS) is an organization founded in 1967 to nationally coordinate the building code and public safety interests of the nation's fifty states and several territories. The voting membership of the Conference is comprised of one governor-appointed delegate from each of the states and three U.S. territories. These delegates, for the most part, at the statewide level have the broadest responsibilities for health and life safety in new and existing buildings.

The Conference learned last week that as in FY 1984, the FY 1985 budget proposal would terminate funding for the Center for Building Technology and the Center for Fire Research of the National Bureau of Standards (NBS). As we understand it, the rationale offered is that research performed by these two Centers should be conducted by state and local governments and the private sector. The Conference is gravely concerned over this matter. We believe that testimony before Congress during the FY84 hearings clearly showed the invalidity of this position.

The centralization of such research at the Federal level is clearly in the national interest, and well within the scope of President Reagan's "New Federalism." Were it otherwise, we would have a chaotic and unproductive research system in which each state that could find resources for such testing and research, quite probably, would duplicate research being done in another state or states. This would clearly be a waste of taxpayers' dollars.

State and local governments neither have the research facilities nor the funding resources to conduct the building-related research now carried out by these two Centers. NBS has unique facilities and a staff of researchers with worldwide reputations for their expertise. These resources will not, could not, and should not be duplicated by individual states or the private sector.

From the inception of NCSBCS, in 1967, there has been a close working relationship with the National Bureau of Standards. In 1978, a Memorandum of Understanding was signed by NCSBCS and NBS. This Memorandum calls for NBS to provide technical assistance to NCSBCS and conduct research needed by the states in carrying out building regulatory responsibilities. A copy of this Memorandum is enclosed for your information.

The use of NBS' research results by NCSBCS and the states, furthermore, has contributed effectively to the National Bureau of Standards' goal of transferring research results and up-to-date technology to the states, and ultimately for the benefit of building owners and users.

Many technical studies and much research have been carried out in the Center for Building Technology and the Center for Fire Research as a direct result of needs stated by NCSBCS. In 1973, NCSBCS requested the Center for Building Technology to prepare criteria for energy conservation in new buildings in 1974, which were then used by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) as the technical basis for preparation of the ASHRAE Standard 90, "Energy Conservation in New Buildings." This Standard now is used as the basis for the regulation of energy use in new buildings for 48 states. We strongly believe that this is an example of Federal, state, and private sector cooperation at its finest. For the good of the Nation, we must not eliminate a vital participant in these cooperative efforts.

In a more recent example of this relationship, slightly over a year ago, NCSBCS concluded a survey of its delegates to determine the need for additional research in the areas of structural integrity and fire safety in buildings. The results of this survey identified 17 areas of needed research. A request was forwarded to the Center for Building Technology and the Center for Fire Research to undertake the state-needed research relating to structural integrity and fire safety in new building construction. Research is now underway in the Center for Building Technology and the Center for Fire Research in response to this NCSBCS request.

In closing, I would like to reiterate the point that there is no organization presently in the states or in the private sector that could fill the vacuum should the Center for Building Technology and the Center for Fire Research of NBS be eliminated.

On behalf of NCSBCS, its officers and delegates, I respectfully request that your Subcommittee take the necessary steps to restore the budget for both the Center for Building Technology and the Center for Fire Research so that they may continue their most valued research; research that enhances the health and life safety of the citizens of all of our states and territories.

Thank you.

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE NATIONAL CONFERENCE OF STATES ON BUILDING CODES AND STANDARDS, INC.
AND
THE NATIONAL BUREAU OF STANDARDS

I. Introduction

The National Conference of States on Building Codes and Standards (NCSBCS) was formed in 1967 in response to "the need for intergovernmental reforms in the area of building codes," as recommended by the Advisory Commission on Intergovernmental Relations.

From the inception of NCSBCS to October 1976, Secretariat services were provided NCSBCS by the National Bureau of Standards (NBS). These services included administrative and technical support. The authority to furnish this support is contained in sections 2(d) and 3 of the NBS Organic Act (15 U.S.C. 272(d), 273).

Many technical studies and much research have been carried out in the Center for Building Technology (CBT) of the Institute for Applied Technology (IAT) at NBS, as a direct result of stated needs by NCSBCS. Examples of such programs include the Laboratory Evaluation and Accreditation Program, Coordinated Evaluation System, Uniform Regulation of Manufactured Buildings and Mobile Homes, and Energy Use Criteria for Standards. The use of these programs by NCSBCS has effectively contributed to the NBS goal of transferring research results and up-to-date technology to the States and ultimately the building owner and user.

With recent growth and development, NCSBCS has matured to the stage of becoming an incorporated entity with administrative self-sufficiency and independence. When NCSBCS entered into contractual agreements with other Federal Government agencies, it realized, as did NBS, that administrative and logistical support by NBS should be transferred from NBS to NCSBCS, while technical research support should be enhanced so as to further the goals of both organizations.

II. Purpose

The purposes of this agreement are to: (1) set forth a commitment of continued mutual support between NBS and NCSBCS; (2) establish a procedure for appropriate joint program planning and continued technical cooperation between the two organizations; (3) outline the general conditions under which NBS and NCSBCS cooperative efforts will be formulated and conducted; and, (4) set forth those technical and other services to be provided either organization by the other.

Through this cooperative effort, both organizations can work together toward the common goal of improving the building regulatory system through the application of research and technology. This work will contribute to the public welfare by providing a safer, more healthful built environment at less cost.

III. Statement of Intent

The past relationship between NBS and NCSBCS proved to be beneficial to both organizations in developing and applying building technology to the special problems encountered in building regulation. It is, therefore, agreed by both organizations that close cooperation and contact will be maintained in the future so as to bring the resources of both organizations to bear on national problems related to (1) deficient and needed new standards and codes for building regulations, and (2) inadequate processes for regulating building design and construction.

1. NBS will carry out technical and research activities for NCSBCS in the following areas:

   a. NBS agrees to provide technical advice and consultation to NCSBCS—its Board of Directors, Committees and individual States, when requested, in areas in which NBS possesses scientific and technological expertise, within the limits of funds and manpower available and consistent with existing policy regarding such services. Requests for such services will be made in writing.

   b. NBS agrees to provide NCSBCS with the latest NBS technical reports, publications and other results of current NBS building research related to building regulatory concerns.

   c. NBS agrees to undertake research for NCSBCS on building regulatory concerns of national interest, when appropriate and subject to existing resources and programmatic limitations. Such research will be conducted on a cost reimbursable basis, when appropriate, under authority of section 7 of the NBS Organic Act (15 U.S.C. 275a) and in accordance with NBS Project Acceptance Criteria. Any such cost reimbursable research will be undertaken by NBS upon execution of a written research agreement between the two organizations.

d. NBS agrees to duly consider the regulatory research needs of the States as expressed by NCSBCS in planning the NBS building research program.

e. NBS agrees to furnish technical expertise to the NCSBCS Standing Committees. NBS agrees to furnish an appropriate technical staff person to participate in the activities of each of NCSBCS's four Standing Committees: (1) Education and Qualification, (2) Codes Administration, (3) Reciprocity, and (4) Standards and Evaluation, and others as mutually agreed upon. This technical support will be provided by NBS to NCSBCS at no cost to the latter organization. These staff persons will be Associate Members of the respective committees and will be selected by the Chief of the Office of Building Standards and Codes Services, Center for Building Technology. Committee participation shall be in accordance with Article VIII, Section 1 and Section 2, of the NCSBCS Bylaws dated September 23, 1976.

2. NCSBCS will carry out studies for NBS and implementation activities based upon NBS research results in the following areas:

   a. NCSBCS agrees to undertake surveys, data gathering and other studies related to the building regulatory system for NBS, as requested by NBS, when appropriate and subject to existing funds and manpower limitations. Such activities will be conducted on a cost reimbursable basis through an appropriate contract with NBS.

b. NCSBCS agrees to annually prepare and submit to NBS a written list of high priority research needed to address building regulatory and related problems.

c. NCSBCS agrees to share with NBS nonconfidential progress and other programmatic reports relating to building technology, standards and regulations.

d. NCSBCS agrees to implement NBS building research results when and where appropriate and within limits of resources.

IV. Mode of Operation

In order to facilitate the intent of this agreement, the mode of operation will be as follows:

1. NBS and NCSBCS agree that all cooperative activities shall be funneled through a principal point of contact within each organization. These points of contact are to be the Chief of the Office of Building Standards and Codes Services, Center for Building Technology, Institute for Applied Technology, NBS, and the Executive Director of NCSBCS. To facilitate cooperative activities, the Chief of the Office of Building Standards and Codes Services shall also serve as a Technical Advisor to the NCSBCS Board of Directors.

2. Any information resulting from NCSBCS-supported research at NBS of benefit to the general public will be provided to NCSBCS for either release or approval for NBS to release. Any release of such material by NCSBCS will indicate the source of the research and any release approved for issuance by NBS will acknowledge the support

of NCSBCS. NBS will retain the privilege of individual scientists publishing findings resulting from NCSBCS supported research in professional journals and archival literature.

3. Any information resulting from NBS-supported research by NCSBCS of benefit to the general public will be provided to NBS for either release or approval for NCSBCS to release. Any release of such material by NBS will indicate the source of the research and any release approved for issuance by NCSBCS will acknowledge the support of NBS.

V. Termination

NCSBCS and NBS agree that this Memorandum of Understanding may be terminated by either party 60 days after notifying the other party in writing.

E. Ambler

Acting Director
National Bureau of Standards

JAN 03 1978

President
National Conference of States on
Building Codes and Standards, Inc.

January 27, 1978

[Whereupon, at 12:30 p.m., the subcommittee was adjourned.]

APPENDIX

Additional Statements Submitted for the Record

Additional Remarks Concerning
THE NATIONAL BUREAU OF STANDARDS
Submitted by
Dr. Russell C. Drew
Vice President, Professional Activities
Institute of Electrical and Electronics Engineers

Mr. Chairman:

In my testimony on the budget request for the National Science Foundation for FY 1985, it was pointed out that engineering provides the vital linkage between the discoveries of science and the incorporation of these discoveries into the products and services that are the foundation for U.S. industry. The human resource that is committed to the practice of engineering is, of course, a key element that determines whether this "knowledge translation" will be both efficient and successful. We have strongly supported a Federal role in funding engineering research and in stimulating the educational enterprise as important components of a science and engineering policy that is based upon a high degree of enlightened national self-interest.

In addition to these emphases, the Government has an extended role in helping to convert new technology to industrial practice. There are a number of ways in which this may be carried out, both through indirect measures such as tax incentives and through more direct mechanisms such as the Small Business Innovation Research (SBIR) Program. These approaches are very important to the health and performance of the private sector as it competes with other nations which employ close collaboration between government and private industry to gain competitive advantage. These measures are an essential complement to the longer-term basic research support that is provided.

Among the very important components of Government support for a more competitive America are the industry and standards-oriented programs of the National Bureau of Standards (NBS). The NBS has a long and distinguished history of service to U.S. industrial development, and today, with the increasing pressure upon industry, the NBS is more important than ever. The challenges for the NBS are also more significant than ever before, because of the rapid growth of new technology which, in turn, requires new measurement techniques and new standards.

The Government involvement in these areas complements voluntary standards efforts by the IEEE, EIA, ANSI and others. It is particularly important that the Government keep an active involvement because of the beneficial role that it can play as a relatively unbiased middleman. Government is also well suited to an active role on the international front, as well.
In this context, therefore, it is particularly disturbing that again this year as last year, the Institute of Computer Science and Technology at NBS is being faced with a major threat to its continuing existence. Congress acted to restore nearly all of the 70% cut that was proposed last year, but apparently the message did not get through, and this year a cut of some 50% is being proposed.

It is important that the Congress act to restore $5 million to the NBS budget, to enable the continuation of programs conducted at the Institute of Computer Science and Technology which address critical areas for standards developments. These include work on networking, communications protocols, evaluation of Federal automated data processing (ADP) standards and other questions in both the national and international context. Given the importance of computers to the information society that is developing in all the industrially advanced nations of the world, it seems very short-sighted to cut back funding in such a crucial area at the NBS. The argument is put forward that this work is better done in industry. Certainly, in industry, many times the very small budget of the ICST is devoted to certain aspects of these problems, but from the standpoint of the interests of a specific manufacturer. The ICST role is one that provides a forum for industry to consult and express their needs without the ICST becoming an advocate of one company over another. It is important for the U.S. to retain this capability.

There are several other areas where cuts have been proposed that also appear to be "penny wise and pound foolish". Specifically, these include the Centers for Fire Research and Building Technology, which again as last year are proposed for zero Federal funding. The Measurement Assurance Program is also being proposed for a reduction of $1.7 million on the grounds that a combination of user charges and private sector initiatives would enable certain services to continue. Our view is that such cuts appear short-sighted, and much too doctrinaire regarding what is appropriate for the Federal Government to support. We are already losing important calibration services to other countries, and we need to halt this trend and restore the degree of leadership to such measurement programs that formerly characterized all of the areas at the NBS. Accordingly, we support the restoration of $1.7 million to the measurement assurance program in 1985.

I appreciate this opportunity to provide comments on the proposed budget for the National Bureau of Standards, in addition to the National Science Foundation. I will be pleased to provide any additional information on these topics or answer any questions you may have.

WRITTEN TESTIMONY FOR THE RECORD

TO THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

ON BEHALF OF

THE NATIONAL CONFERENCE OF STANDARDS LABORATORIES
INDUSTRIAL SEGMENT

BY

GEORGE RICE, PRESIDENT
PETE ENGLAND, EXECUTIVE VICE PRESIDENT
AND
HARTWELL KEITH, PAST PRESIDENT

FEBRUARY 2, 1984

INTRODUCTION

It is a privilege for us to represent the industrial segment of the National Conference of Standards Laboratories in this written testimony to this Committee. The NCSL was founded about 22 years ago as a means of fostering communication and education in the management of this nation's standards laboratories. From an early beginning the NBS has been the sponsor of the NCSL providing it initially with single point of focus and credibility and over the years a continuity of permanence. In the years since its founding, the NCSL has grown to a membership of something more than 600 laboratories throughout the world, approximately 500 of which are domestic non-government laboratories. Some of these "industrial" members are small businesses, while others are large; some are independent, others are components of larger companies. For some, their business is that of providing a commercial service while for most it is to perform calibration support for the parent company.

Our industrial membership and, we believe, most Americans are as concerned about the size of the Federal deficit as most of you. We recognize that the Federal budget is a means whereby priorities may be set among competing government activities with differing perceived benefits to society. We also are aware that the budgeting process is correctly a political one which allows for determining those societal benefits, for setting priorities and for limiting the economic damage to the future which could result from excessive decifits. Our plea is that you consider the long term effects on the NBS - its capabilities and the way it provides its services - and the slowness with which those effects are seen in industry and commerce.

NCSL INVOLVEMENT

Last year, for the first time since its founding, the NCSL became actively engaged in discussions of the NBS budget. This followed our prior year's interest in the Congress' consideration of revising the enabling legislation (Organic Act) for the NBS. We are neither professional lobbyists nor captive surrogates for the Bureau; rather, we are concerned users of NBS services. We are supportive of the Bureau in its programs which meet our perception of the nation's measurement needs. We are critical when those programs do not appear to address those needs either qualitatively or quantitatively. For example we deplored the reduction in services offered during the late 70's and the perceived deterioration in the quality of those services. We also applaud recent actions in the Bureau to upgrade these services by selective staff increases and equipment improvements. The proposed budget before you has similar overtones. We support the $2.5M increase suggested for process quality control but are disappointed that the full $13.5M was not proposed.

Within our area of interest we frequently have been called upon (together with other users of NBS services) to assist in assigning priorities to the several competing services. For the most part we think this has worked well. However, it is difficult or impossible for us to prioritize work in support of our needs relative to other work carried out by the Bureau. We suspect it would be equally difficult for those involved in other arenas (e.g., building technology, fire research, research into fundamental constants, etc.) to determine the importance of that work relative to these measurement services.

In some cases these other areas are considerably more visible than measurement services and the direct constituency is both larger and more vocal, perhaps even more persuasive. Our task is not to try to convince you that these other areas are less important than calibration services. Our task is to try to convince you that measurement services represent a fundamental mission of the Bureau requiring your careful consideration and reasoned judgment.

SPECIFIC AREAS OF CONCERN

In our review of the NBS FY85 budget proposal we limited ourselves to those aspects which are of interest to our industrial membership: the industrial calibration and standards laboratories of the nation. We did not examine the issues involved in such areas as fire research, building technology, computer research, biotechnology research, etc. We believe these topics, however important, will receive support from other constituencies whose interests lie with these concerns. We are concerned with the adequacy of calibration services provided - including MAPs and SRMs. We firmly believe providing these services which affect commerce and manufacturing in defense and commercial areas is a fundamental mission of the Bureau. Therefore, we have more than a passing interest that this vital activity receive the attention it deserves. It is our judgment that this Committee could do no greater service to the technical strength of the nation than to prevent the continuing deterioration of this important facet of the NBS.

Areas of the NBS budget of concern to us are:

R&D supporting calibration services (generally) and MAPs (specifically);
R&D supporting SRMs;
Measurement services quality control and documentation;
Training services, including seminars and publications; and
Existing and emerging measurement needs.

COMMENTS ON SELECTED SPECIFIC AREAS

For a number of years our membership has become increasingly concerned about the deterioration of services provided by the Bureau - specifically calibration services. The effects are slow to mature and even slower to be perceived. Reduction in budgeted amounts for support of calibration services, reprogramming of calibration service funds and personnel to other mandated tasks, loss of personnel (to retirement or other areas of government service) without replacement, and failure to upgrade equipment and technical capabilities have all contributed to this increasing concern.

Calibration services are usually not glamorous nor do they attract high political visibility; rather, they include the vital day-to-day activities essential to commerce, industry and - yes - to research and development, in all sectors of the American economy. They depend upon a research base which continually strives to improve upon our knowledge of measurement phenomena, the sources of measurement error, and the means to reduce that error or to otherwise compensate for it.

Last year the Administration proposed that the research and development funds for Measurement Assurance Programs (MAPs) be deleted from the Federal budget and that these costs be recovered from the users of the MAP services. The Congress decided that such a step should not be taken precipitously and, accordingly, restored 80% of the money with direction that the NBS initiate a study to determine the effects of selected price increases on the demand for calibration services. The Congress further directed that these funds be "ramped" down at 20% per year with so-called user fees being increased to provide the resource for continuing research and development of these services. Before the study has been completed, the Administration has again proposed complete elimination of the $1.2M for MAP R&D which would have been the FY85 amount.

Initial results of the study aimed at determining the impact of price increases for selected services upon the demand for those services indicates a disturbing conclusion. On the one hand total income generated by the fees has remained about the same; however, the number of services requested has declined. The impact of the decline is the ultimate deterioration (or, at best, the failure to improve) the measurement base for industry's quality control programs.

Measurement Assurance Programs (MAPs) are more advanced methods for transferring quantities of measurement to the measurement community. Basically, MAPs serve to quantify the total uncertainty in the measurement process including the equipment component, the environment component, the method component and the human component. (The classical calibration service of the Bureau merely identifies the equipment component of uncertainty; all other components are either ignored or are attempted to be estimated by the user.) This ability to quantify the total uncertainty makes a MAP a significantly more powerful method of disseminating the various national standards to industry.

It has been mentioned by some that the services provided by the Bureau can easily be afforded by the larger companies which use those services. Although we could argue that point our purpose here is not to defend the larger companies. The NCSL has many small organizational members (and there are numerous small firms not yet members of the NCSL) which are certainly among those for whom we are appearing. No firm - large or small - has, as far as we know, ever suggested that NBS calibration services be provided free. We have always supported the idea that a fee should be charged; this fee should be set to recover the operational costs incurred by the Bureau to provide that service. However, we strongly object to the concept that NBS research and development - a function which will benefit the nation as a whole and for which the beneficiarcies are unidentifiable members of our society who may use that service in the future - be paid for out of user fees for current, possibly unrelated, services. Yet that is just what is proposed in this budget and what was agreed to in principle by the approval of the FY84 budget. Of the number of services which the NBS provides to the public, few have the "point of sale" identification as do calibration services and SRMs . This identification has made it easy to suggest that the users (purchasers) of these services are beneficiaries of a government function and that they should be expected to pay in total for that function. However, present users of a service are not necessarily the beneficiaries of research and development conducted for future services. Thus, identification of the beneficiaries is not possible and users of today's services should not be required to underwrite the costs of that research on a "pay as you go" basis.

Based on the words in the Organic Act it is not necessary that the fees charged for calibration services recover their costs. Rather, it is clear that the fee be "reasonable." It is surmised that reasonableness of the fee was to be determined partly on the cost to provide the service, partly on the basis that more users should be encouraged, and partly on the basis that small company users should not be frozen out because of price. Implicit in these considerations is the necessity to have some price set which would discourage frivolous or unnecessary use of this valuable resource but which would encourage necessary or desirable use.

We do not here, however, argue that the $1.2M for MAP R&D be restored as such. Rather, we support the proposal that the $1.2M be restored and then reprogrammed to the entire calibration services section of the budget. We strongly believe that MAPs are merely one means of transferring a quantity to the public and, therefore, are only components of the larger calibration service function. Contrary to information provided by others, MAPs are not just for laboratories involved in state-of-the-art measurements. MAPs are important to any laboratory interested in quantifying the total uncertainty of its measurement process, regardless of the size of the uncertainty. User uncertainties vary according to the equipment available and to the methods employed as well as to the technical competence underlying the measurement made by the laboratory.

The reduction in calibration services offerred by the NBS which accompanied budget and staff reduction in those areas responsible for the services has also been felt by industry. In some cases, alternate sources for these services have been located (e.g., calibration services for reference magnets which had been discontinued by the NBS are available to defense contractors from the Navy's Primary Standards lab). Some companies have elected to purchase such services from the NRC of Canada whose policy relating to funding research and development in measurement and standards areas is more appealing then is U.S. policy and whose fee structure - even considering the surcharge applicable to non Canadian users - is considerably more attractive than that of the NBS. These areas are little more than stop gaps; the need exists for the NBS to provide these services at a reasonable price.

Examining alternatives to the measurement services now provided by the NBS is complicated by the fact that at some point in the measurement hierarchy a measurement service by the Bureau will be necessary. Although it is true that most derived measurements can be linked in a hierarchy to the Bureau's basic references the cost to the nation could be staggering. This country, unlike most of our trading partners, does not have a formalized government system of calibration services. In some countries this is carried out by various levels of government laboratories, in others the levels below the national laboratory are reviewed and approved by the national laboratory. In the U.S. there exists no formal government hierarchy of standardizing laboratories; we rely on informal, widely dispersed, voluntary action. Thus, each entity in the measurement arena decides for itself its calibration needs, identifies the sources to meet these needs, and operates quite independently of all other entities. Because there is no government calibration service outside of the NBS, each entity must decide whether to use the NBS or to use a commercial facility. The first step in this decision process is to determine whether the commercial facilities possess the required capability (i.e., can they make the required measurement with the degree of uncertainty necessary). Derived units of measure are often intimately linked with the method of their measurement. Commercial facilities should not be conceded the responsibility for defining such units by the way they measure them. If no commercial facility exists for the quantity to be measured or if the accuracy required exceeds the commercial facilities' capability, the only alternative is the NBS. The most difficult question, though, is that first step. There exists no authoritative reference of laboratories providing calibration services, of the quantities those laboratories can measure, nor the total uncertainty with which they can make the measurements. The NBS has intuitive knowledge of some of these labs but intuition is not the same as objective approval. Even the intuitive knowledge is useless; the NBS is naturally reluctant to name a laboratory felt to be capable because it may appear as an endorsement.

For one segment of the economy - industry - the services provided by the Bureau (calibrations, SRMs, technical training and seminars, etc.) are of increasing importance to the attainment of quality which is an essential ingredient to productivity improvement programs and to our success in international competition. The need for U.S. industries, defense contractors, consumer product industries, medical and health services institutions, and others, to improve product quality and productivity is almost universally recognized. To assure the required quality and reliability, continual assessments must be made on the product, processes must be monitored, inspections made, conformance to specifications, documentation and drawings must be verified, and examinations and analyses must be performed. At the foundation of all of these activities are measurements. As industry strives to improve its implementation of newly developed quality control methods it is counter productive to allow the foundations for those methods to be eroded. Last year the NCSL published the results of a survey into national measurement requirements (existing and projected needs) as a means of identifying a broad spectrum of present and near term improvements needed at the NBS. (A copy of that report will be provided separately.) Concurrently, but independently, the NBS initiated a study of its own which resulted in an initiative for $2.5M in this area of emerging technology and increasing capability. A review committee external to the NBS agreed with the need for this improvement; however, the need exists for the entire amount originally proposed which totalled something more than $13M. A comparison of the national measurement requirements report and the NBS original proposal for this initiative discloses a significant degree of agreement on the needs.

Some elements of the Bureau's measurement service needs are at the cutting edge of technology - millimeter wave, infrared and other radiant energy including lasers, etc. - while others are within the existing knowledge base. Both types exist in the national measurement requirements report and in the original proposal for the calibration initiative.

The conduct of measurement-related seminars remains of singular importance to our industrial membership. While it is true that fees for this vital activity usually cover the cost to NBS to provide it, it is also true that key individuals are often diverted from other essential tasks in order to prepare and deliver the course material. As this relates to manpower ceilings as much as to the magnitude of the budget it might be appropriate to include a "level of effort" amount of funds and heads to support this role. Whether the full amount of this "level of effort" is recoverable from users in any given time period is not known; over the long term much (if not all of it) would be thru appropriate fees.

RECOMMENDATIONS

We urge this Committee to strongly consider the following proposals as it deliberates this budget:

(1) Restore the $1.2M for MAP R&D and reprogram the funds to calibration services quality control and documentation;

(2) Increase the calibration services initiative to $13.5M to include all elements originally studied by the review committee;

(3) Restore the $100K for SRM development;

(4) Review the policy of cost recovery for R&D based not so much on what may happen to demand but on the fact that such expenditures benefit the nation as a whole and at some future time;

(5) Determine an appropriate budget, with manpower ceilings, for seminars and training.

In this consideration we hope that you will bear in mind the mission of the NBS - and in particular the Organic Act's statement that the functions of NBS consist in: "...the custody of the standards; the comparison of the standards used in ... manufacturing [and] commerce ... with the standards adopted or recognized by the Government ... [and] the solution of problems which arise in connection with standards ..." The Organic Act also required a "reasonable fee" be charged for comparisons and calibrations.

The NBS has grown considerably since the Organic Act was made law in 1901 - grown physically and in capability, in credibility and in mission. But, in growing, nothing has occurred which has reduced or eliminated the need which gave rise to the NBS: a requirement for a national standardizing laboratory purposed to assure fairness in commerce and interchangeability in manufacturing.

Precision measurements are a basic aspect of every area of science and technology. However, without a continuing research and development effort at the National level into all components of measurement; without an effective and practical delivery system to the Nation's Industry of the results of this R&D effort; without a strong and viable National Measurement System, the long-term impact to this country's leadership in high technology and this country's health, economy and security will be in jeopardy.

The NBS is a national asset; what is done to (or for) the NBS today will determine the health of that institution for years to come. We owe it to our future - the generations of tomorrow's users of NBS services - not to let its capability deteriorate further. We owe it to the present - the users of today's services - to upgrade its programs in calibration services and SRMs to meet the real needs which exist now.
0883y/14y

OBSERVATIONS ON JAPANESE/AMERICAN HOUSING TECHNOLOGY EXCHANGE

Ronald E. Gebhardt
Vice President
Product Development Division
RYAN HOMES, INC.

Background

The typical American single family builder has improved his method of house design and construction and material selection through self-generated innovation and by employing concepts of construction emanating from the building materials and equipment industries. To a limited degree, material and design concepts have filtered from European sources in modest numbers.

There has been little input from Japan.

Following World War II, the Japanese housing industry set about replacing destroyed shelter that had created a shortfall of over 4 million dwellings. This led the Japanese to emphasize prefabricated housing and establish a national building code that would be applicable everywhere. Simultaneously, the Japanese steel industry lobbied to have government support for the use of steel in the prefabricated housing industry.

Japanese companies began to study the American prefabricated housing industry and committed themselves to the development of building materials created from indigenous products to reduce dependence on imported products.

Current Exchange of Information

During the last several years, the National Association of Home Builders has provided a forum through which the Japanese prefabricated housing industry could present to American builders their concepts of construction. At the Annual Home Builders' Convention, Japanese companies have conducted seminars such as the one whose outline is attached that took place in Houston on January 22, 1984. Presentations such as these have been extremely professional, and have employed high quality English language color films and slide presentations that have taken the audience into their factories, research laboratories and on to the construction site. In this years presentation, three of the major executives of the four companies spoke in English and responded to questions from the audience. Most had English language literature for distribution, describing their products and processes in written and pictorial form.

Visit to Japanese Prefabricated Industry

In the fall of 1983, a study tour sponsored jointly by the NAHB and Global Link, Inc. of Venice, California visited Japan for nearly two weeks of intense study of the housing industry in general and the prefabricated industry in particular. This included visits to the Ministry of Construction, several of the large builders and various industry associations. Our hosts took us into their research & development facilities, their design & engineering departments, their factories and to their job sites.

We observed robotic assembly and welding devices, innovative products produced from indigenous materials, and computer aided design equipment employed in research, engineering and at the point of sales in model homes. Doors were wide open and substantive information was provided.

Several of these Japanese companies have visited the United States and in the case of Ryan Homes, such visitors have come to our plants and office facilities not only to learn our methods, but to provide follow-up information that had been requested in Japan. In all of these cases, language and translation have not been a significant problem.

Another such visit to Japan is about to take place, sponsored jointly by the Technology Transfer Institute and Automation in Housing & Manufactured Home Dealer magazine. An outline is attached.

Conclusions & Summary

1. Our experience indicates an active willingness to provide as well as receive information regarding industrialized housing.

2. The current Japanese prefabricated housing industry employs designs that reflect the use of indigenous materials such as steel and sand/cement in lieu of wood -- due to their limited forest products industry. The designs also reflect a highly conservative criteria for earthquake and typhoon, the extraordinarily high cost of land and a sophisticated, vertically integrated, prefabricated housing industry component that is willing to compromise economy and aesthetic design for speed and automation.

3. It is unlikely that any of the major Japanese housing producers will introduce to the United States their costly and peculiar to Japan prefabricated designs either through export or U.S. production. It is more likely that such a company would learn the American building system by entering first as a conventional American builder and subsequently use a modified version of their Japanese prefabricated system to provide both functional design and aesthetics with a competitive cost/value relationship.

4. It is possible that American companies could lend the Japanese some of their technology to improve the cost/value relationship of the Japanese houses constructed in that country. This has already started by the "Japan 2x4 Home Builders Association" and Mitsui.

REG/cmt
2/5/84
Attachments

SUNDAY 1-22-84

9:30-11:30 am

The Manufacturing and Selling of Homes in Japan Today

Meeting Room 311, Astrohall

Five top Japanese home manufacturers/builders will discuss the manufacturing, marketing and selling of their products, emphasizing how each company's homes are differentiated from those of its competitors and which distribution channels have been the most effective.

Moderators
- *Sanford R. Goodkin*, Chairman, The Goodkin Group, Del Mar, California
- *Noriko Yamamoto*, President, Global Link, Inc., Venice, California

Speakers
- *Tohru Konishi*, General Manager, International Development Division, Misawa Homes Co., Ltd. Japan
- *Katsuya Terada*, President, Daiwa House Corporation, Dallas, Texas
- *Akio Kobayashi*, Director, Research and Development, National House Industrial Co., Ltd., Japan
- *Shuhei Kawai*, Manager, Planning and Management Control Department, Sekisui Heim Headquarters, Sekisui Chemical Co., Ltd., Japan
- TOKUTARO KWAI - DIAWA

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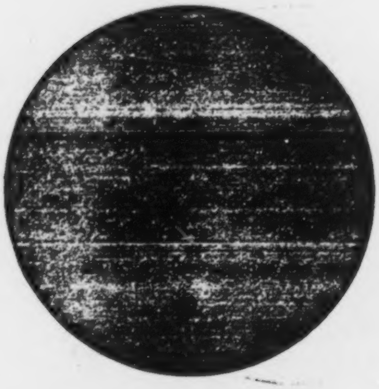

JAPAN UNVEILS

An Invitation to Japan and other parts of Asia

INDUSTRIAL STUDY MISSION TO EXAMINE JAPANESE STATE-OF-THE-ART TECHNOLOGIES

Technology Transfer Institute:

A Tokyo-based management consulting firm with branches in Los Angeles, New York, London, Düsseldorf, Paris, and Singapore, Technology Transfer Institute (TTI), was established in 1969 to promote international exchanges of information and ideas in engineering, manufacturing and science. TTI Los Angeles caters to North American business executives, technical experts, scientists, and professionals by giving them an opportunity to view state-of-the-art technology and management style in Japan as well as other parts of Asia through study missions, technology transfer forums, seminars, and research studies in many different industries and a variety of fields. TTI has organized more than 900 such programs. TTI-Los Angeles also offers Japanese Industrial Research Studies such as Robotics, Automobile Weight Reduction, Semiconductors, Optical Communications, Flexible Manufacturing Systems and Others.

Technology Transfer Institute
624 So. Grand Ave. Suite 2407 • Los Angeles, California [illegible] • [illegible] 213 628-9381 • Telex 29-5363 • Fax 213 628 0055
Tokyo • New York • London • Singapore • Dusseldorf • Paris

February 9, 1984

Dear Sir:

The New Technology is laying a solid foundation for the prefabricated housing industry. Modern mass production techniques are going to result in more and more factory-made dwellings to house the world's growing metropolitan populations.

But let's not brand efficiency with the label of duplication. Computer design techniques are actually allowing mass-produced homes to be tailor-made to suit the geographical requirements of their locations and the individual tastes of their inhabitants.

In one of the world's more crowded nations, Japan, prefabricated housing is by necessity the rule rather than the exception. Japan's advanced technology may well become the key to your own company's future as the international market expands and lends itself to worldwide progress.

Technology Transfer Institute(TTI) is pleased to invite you to take part in a two-week study mission to Japan on "Prefabricated Housing" as part of our international program of technology transfer. The mission, slated for April 7-16, 1984, is your key to a bright future in this growing field. Under the guidance of Team Director Mr. Don Carlson, Editor/Publisher of Automation in Housing and Manufactured Home Dealer, you will see first-hand Japan's major prefab housing facilities. During on-site consultations you'll talk to executives and researchers and learn of the opportunities for possible joint venture agreements.

For a reasonable fee of $3850.00, which would normally be much higher for an individual endeavor, you will gain valuable insight into the future trends affecting this field and ultimately, your own career path.

We look forward to making you a part of our technology transfer program.

Most sincerely,

Kazuo Moro
Director

KM:mnp
encl.

INTERNATIONAL INDUSTRY STUDY MISSION TO JAPAN ON PREFABRICATED HOUSING TECHNOLOGY IN JAPAN

April 7 - 16, 1984

Team Director: Don Carlson
Editor/Publisher
Automation in Housing &
Manufactured Home Dealer
Carpinteria Calif.

Jointly sponsored by

Technology Transfer Institute
Los Angeles, Tokyo

Automation in Housing & Manufactured Home Dealer
Carpinteria, Calif.

OBJECTIVES

The housing industry of tomorrow will require efficient mass production, dwellings with inherent mobility, and continually reduced use of lumber.

Such high technology is already taking place in Japan, where overcrowding combined with the country's advanced technology, makes traditional construction by definition obsolete.

Since its inception in the late 1950's, Japan's prefabricated housing industry has continued to grow, especially in light of recent innovations in structural components utilizing fiber-board and aluminum panels set in steeel frames.

The use of new ceramic materials has revolutionized the industry. Known as PALC(Precastable Autoclaved Lightweight Ceramics) and composed of silica and limestone, the mixture congeals after air bubbles are pumped into it and it is subsequently heated in a large pressure cooker.

The material that results weighs less than a fourth as much as concrete but is soundproof, fire resistant and strong enough to bear up amidst major stresses such as earthquakes and floods.

New materials have opened the door to new designing methods. Japanese manufacturers have the capacity to mass produce thousands of homes annually - about twice as many as the annual quota of America's largest building company. Yet, computer graphics allow for individualized home design projects.

It is also possible to piece together large cubes or units to form structures of various sizes and shapes suitable for unusual or small land parcels.

Thus we can see that the New Technology allows for greater simplicity in materials use and in design.

The study mission to Japan on "Prefabricated Housing," slated for April 7-16, 1984, will provide participants with a first-hand look at future trends in this all - important discipline.

Metropolitan population increases around the globe will soon require new planning methods on the part of major housing industries, and for this reason, researchers are encouraged to utilize this mission for their ongoing endeavors.

LIST OF PLACES FOR POSSIBLE TECHNICAL VISIT

1. MISAWA HOMES CO., LTD. TOKYO

   Misawa Homes, famous for its research and development of new construction technology, which has produced capsule construction technology and "House 55", had a sales figure of $519 million in 1983, and is a leading competitor with Sekisui House because of its ongoing interest in prefabricated housing.

   The company has begun to produce houses from a new ceramic material known as PALC(Precastable Autoclaved Lightweight Ceramics). The company also produces glass materials.

2. NATIONAL HOUSE INDUSTRIAL CO. OSAKA

   Japan's largest manufacturer of housing construction materials, this company is a major supplier of "House 55" components.

   An affiliate of Matsuhita Electric Industrial Company and Matsushita Electric Works Company, National House Industrial also produces quality 2x4 houses.

   The Osaka-based firm recently completed the expansion of its member facility as well as the first stage of its new distribution center's construction.

3. DAIWA HOUSE INDUSTRY CO., LTD. OSAKA

   Daiwa House Industry Co., Ltd. is one of Japan's "Big 5" prefabricated housing makers, with an emphasis on large scale production of Western-style homes and apartments.

   Japan's third largest prefabricated housing manufacturer Daiwa House Industry, utilizes computer graphics to allow home buyers to design and estimate costs of prospective Daiwa houses on a video display terminal.

   The company is strengthening its subsidiaries and is beginning to add resort area development to its list of accomplishments.

4. SEKISUI HOUSE CO., LTD. OSAKA

   Sekisui House Co., Ltd. is Japan's number one producer of prefabricated houses. Specializing in the production of low-price Western-style housing of the "BK-V30" type as well as low cost apartments, Sekisui plans to sell 40,000 housing units in its January '84 term.

   Famous for its fiberboard and aluminum panel housing, the company had sales of $2 billion last year.

ITINERARY

April 7(Sat)		Los Angeles/Tokyo
	AM	Orientation meeting at Los Angeles Airport Hotel
	PM	Depart for Tokyo
April 8(Sun)		Tokyo
	PM	Arrive in Tokyo
April 9(Mon)		Tokyo
	AM	HALF-DAY SEMINAR on "Prefabricated Housing in Japan"
	PM	Technical visit
April 10(Tue)		Tokyo
	AM	Technical visit
	PM	Technical visit
April 11(Wed)		Tokyo/Osaka
	AM	Transfer to Osaka by JNR Bullet Train
	PM	Technical visit
April 12(Thu)		Osaka
	AM	Technical visit
	PM	Technical visit
April 13(Fri)		Osaka
	AM	Technical visit
	PM	Technical visit
April 14(Sat)		Osaka/Kyoto
	AM	Technical visit
	PM	Transfer to Kyoto by JNR train

TOUR CONDITIONS AND GENERAL INFORMATION

1. Members of the Mission	20
Number of Participants	18
Team Director	1
Interpreter/Project Manager	1

2. Cost of Mission : 3850.00($2400.00 for spouse)

Included in the Cost -

- Airfare(group fare, economy class, round trip)
- Land Cost: hotel(double occupancy), breakfast, ground transportation and tips
- Team Director
- Interpreter/Project Manager
- Planning and Arrangement of the Program
- Preparation of Background Information and Printing
- Management Fee: administration, correspondence(domestic and overseas)
- Seminar Registration

Not Included in the Cost -

- Lunches and Dinners(unless noted otherwise)
- Transportation of Excess Baggage(maximum 2 pieces per person)
- Items of Personal Nature(laundry, dry cleaning, wines, liquors, cables, etc.)
- Insurance(individual)
- U.S. Departure Tax and Airport Taxes Abroad

Single room supplement : $300.00

AIR TRANSPORTATION

Airfares quoted are based on round trip, economy class air transportation and on air tariffs in effect on March 1,1983 which are subject to change without notice and are based on ground inclusive tour(GIT) air fares from the West Coast or from New York which requires a minimum of 10 people travelling together throughout the itinerary. If there are insufficient number to qualify for the group fares, the lowest applicable individual fare will be charged.

LAND COST

Cost of land arrangements are quoted in U.S. dollars per person on a double occupancy basis and are based on tariffs and rates of exchange in effect on March 1,1983. The tour fares are based on 17 passengers. Cost of land arrangements are subject to adjustment if exchange rates fluctuate or if the number of passengers falls below 17, in which case all rail transportation will be first class.

"PREFABRICATED HOUSING
TECHNOLOGY IN JAPAN"
April 7 - 16, 1984

REGISTRATION FORM

---

1. Name ______________________ Title ______________

   Company ______________________________

   Address(Please specify street and street number)

   ____

   City ______________ State __________ Zip __________

   Telephone ______________________ Telex ______________

   Home address ______________________________

   City ______________ State __________ Zip __________

   Telephone ______________

2. Will you be accompanied by spouse? Yes No

   Spouse's Name ______________________

3. Room Accommodations: Single _____ Twin(sharing) _____

4. I(We) will attend the orientation meeting and depart with the group _____

5. I(We) will not attend the orientation meeting and depart individually from: (Specify airport and city) ______________________

6. I(We) will return as scheduled with the group. _____

7. I(We) will not return as scheduled with the group. Please arrange my(our) return as follows: ______________________

   ____

8. A deposit of $ _____ is enclosed(deposit requirement is $500.00 per person)

______________________ Signature

______________ Date

Return to: TECHNOLOGY TRANSFER INSTITUTE
624 S. Grand Ave. suite 2407
Los Angeles, CA 90017

ELDON RUDD
4TH DISTRICT, ARIZONA

COMMITTEE ON APPROPRIATIONS

Congress of the United States
House of Representatives
Washington, D.C. 20515

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WASHINGTON, D.C. 20515
(202) 225-3361

DISTRICT OFFICE:
6900 E. CAMELBACK ROAD
SCOTTSDALE, ARIZONA 85251
(602) 241-2801

March 1, 1984

Hon. Doug Walgren
Chairman, Subcommittee on
Science Research and Technology
2319 Rayburn House Office Bldg.
Washington, D.C. 20515

Dear Doug,

It has come to my attention that during the Subcommittee's hearings on February 2nd and 7th on the National Bureau of Standards (NBS) authorization bill, testimony was heard in support of H.R. 4490, a bill to authorize a "one-time" study of metric use in the United States and the impact of metric conversion.

As you may know, the General Accounting Office made an exhaustive study in 1978 and issued one of the most complete and objective reports on metric use and conversion. The GAO found that the benefits of metric conversion would be negligible, but that costs would be tremendous--in the billions of dollars. In light of the GAO report, it is my view that another costly study, such as that proposed in H.R. 4490, is unnecessary.

Enclosed is a statement on the question of another metric study. I would appreciate your assistance in seeing that it is inserted in the record for the Subcommittee's February 2nd hearing.

I would also appreciate being kept apprised of any related action on this subject.

Thank you, in advance, for your attention to these requests.

With best regards,

Sincerely,

Eldon

Eldon Rudd
Member of Congress

ER:gg
Enclosure

cc: Hon. Judd Gregg

STATEMENT OF
HONORABLE ELDON RUDD
HOUSE SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

MR. CHAIRMAN, TWO YEARS AGO, THE 97TH CONGRESS TOOK A VERY POSITIVE STEP IN AGREEING WITH PRESIDENT REAGAN'S DECISION TO ELIMINATE FUNDING FOR THE UNITED STATES METRIC BOARD, AN AGENCY WHICH CLEARLY EXCEEDED ITS AUTHORITY IN PROMOTING METRIC USE CONTRARY TO THE INTENT AND SPIRIT OF THE 1975 METRIC CONVERSION ACT WHICH CREATED IT.

IN A 1978 REPORT TO THE CONGRESS ON THE METRIC SYSTEM AND THE IMPLICATIONS OF METRIC CONVERSION, THE GOVERNMENT ACCOUNTING OFFICE (GAO) UNDERSCORED THAT IT IS NOT U.S. POLICY TO CONVERT TO THE METRIC SYSTEM.

THE 1978 GAO REPORT, "GETTING A BETTER UNDERSTANDING OF THE METRIC SYSTEM -- IMPLICATIONS IF ADOPTED BY THE

UNITED STATES", WAS ONE OF THE MOST COMPREHENSIVE AND OBJECTIVE STUDIES OF METRIC CONVERSION. THE EXHAUSTIVE 757-PAGE REPORT WAS BASED ON AN INDUSTRY-BY-INDUSTRY STUDY THROUGHOUT THE ECONOMY, AND COOPERATION WITH FEDERAL AND STATE GOVERNMENTS, TRADE ASSOCIATIONS, AS WELL AS REPRESENTATIVES OF CANADA'S METRIC COMMISSION, THE UNITED KINGDOM'S METRIC BOARD, AND BRITISH AND CANADIAN INDUSTRY REPRESENTATIVES. AMONG THE GAO REPORT'S CONCLUSIONS:

- THE SPECIFIC EFFECTS OF METRIC CONVERSION ON OUR ECONOMY ARE UNDETERMINABLE, BUT THE COST WOULD BE SUBSTANTIAL -- IN THE BILLIONS OF DOLLARS -- RESULTING IN HIGHER CONSUMER PRICES. DESPITE THESE SUBSTANTIAL COSTS AND HIGHER PRICES, THE SUPPOSED BENEFITS OF METRIC CONVERSION ARE QUESTIONABLE IN ALMOST ALL AREAS.

- AMERICAN FIRMS HAVE BEEN TRADING FOR CENTURIES WITH COUNTRIES THAT USE VARIOUS MEASUREMENT SYSTEMS, HAVE DIFFERENT REQUIREMENTS AND LAWS THAT MUST BE COMPLIED WITH, AND SPEAK DIFFERENT LANGUAGES. NO EVIDENCE WAS SHOWN THAT TRADE WOULD BE SIGNIFICANTLY AFFECTED BY CONVERTING TO THE METRIC SYSTEM OR REMAINING WITH THE CUSTOMARY SYSTEM.

* THE PURPORTED BENEFITS ASCRIBED BY PROPONENTS OF METRIC CONVERSION -- FOR EXAMPLE, STANDARDIZATION AND RATIONALIZATION OF MEASUREMENTS -- HAVE TAKEN PLACE UNDER THE CUSTOMARY SYSTEM WITHOUT METRIC CONVERSION.

* THE FOLLOWING SECTORS OF THE ECONOMY CAN SHOW NO SIGNIFICANT BENEFIT FROM METRIC CONVERSION, AND CAN CONTINUE TO OPERATE WELL UNDER THE CURRENT DUAL SYSTEM OF MEASUREMENT:

--U.S. WORLD TRADE
--U.S. ENGINEERING STANDARDS
--THE FASTENER INDUSTRY (SCREWS, NUTS, BOLTS)
--TRANSPORTATION
--AUTOMOBILE DEALERS
--THE METAL PRODUCTS INDUSTRY
--THE RUBBER INDUSTRY
--THE PETROLEUM INDUSTRY
--THE AEROSPACE INDUSTRY
--THE PAPER INDUSTRY
--SURVEYING AND MAPPING
--U.S. LABOR
--WEATHER REPORTING
--SPORTS
--CONSUMERS
--GOVERNMENT (ALL LEVELS)

DESPITE THIS THOROUGH AND COMPLETE STUDY OF METRIC USE AND CONVERSION, LEGISLATION, H.R. 4490, HAS NOW BEEN INTRODUCED AND REFERRED TO THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY TO AUTHORIZE YET ANOTHER "ONE-TIME" STUDY OF METRIC USE IN THE UNITED STATES AND ANALYZE THE IMPACT OF METRIC CONVERSION. IT IS MY UNDERSTANDING THAT THE SUBCOMMITTEE MAY TAKE UP THIS LEGISLATION OR AUTHORIZE THIS STUDY UNDER THE FY85 NATIONAL BUREAU OF STANDARDS (NBS) AUTHORIZATION BILL. THERE IS NO NEED FOR ANOTHER COSTLY STUDY.

NINE YEAR'S AGO, THE 94TH CONGRESS WAS FACED WITH A MAJOR DECISION CONCERNING OUR NATION'S POLICY ON WEIGHTS AND MEASURES, NAMELY, WHETHER OR NOT CONGRESS, AS THE SOLE BODY DELEGATED WITH SUCH AUTHORITY UNDER THE CONSTITUTION, SHOULD COMMIT THE UNITED STATES TO A NATIONAL POLICY OF METRIC CONVERSION.

THE RESULT OF CONGRESS' DELIBERATION WAS THE METRIC CONVERSION ACT OF 1975, WHICH PROVIDED FOR A CONTINUATION OF THE EXISTING VOLUNTARY POLICY. THAT POLICY WAS AUTHORIZED BY CONGRESS AS FAR BACK AS 1866

AND ALLOWS USE OF EITHER METRIC OR OUR CUSTOMARY SYTEM OF WEIGHTS AND MEASUREMENTS.

I DO NOT OPPOSE THE USE OF METRIC IN THE UNITED STATES. HOWEVER, I STRONGLY OPPOSE GOVERNMENT'S UNWARRANTED PROMOTION AND COSTLY IMPOSITION OF METRIC CONVERSION ON THE AMERICAN PEOPLE. FORCED CONVERSION TO METRIC HAS NEVER BEEN AUTHORIZED NOR ENDORSED BY CONGRESS.

NO FREE COUNTRY IN THE WORLD HAS CONVERTED ITS ECONOMY TO THE INTERNATIONAL SYSTEM OF UNITS (SI), THE WAVELENGTH-BASED METRIC SYSTEM ADOPTED BY THE GENERAL CONFERENCE OF WEIGHTS AND MEASURES IN 1960.

WHILE THE 1975 METRIC CONVERSION ACT DID NOT AUTHORIZE METRIC CONVERSION, IT AND THE U.S. METRIC BOARD HAVE LEFT THE AMERICAN PEOPLE AND THE PRIVATE

SECTOR IN GREATER DISARRAY ABOUT WHAT THE NATION'S POLICY IS.

MAJOR PUBLIC OPINION POLLS HAVE SHOWN THAT A VAST MAJORITY OF THE AMERICAN PEOPLE DO NOT WANT TO REPLACE OUR CUSTOMARY SYSTEM OF WEIGHTS AND MEASURES WITH METRIC. THAT WAS A PRIME REASON THE 1975 ACT DID NOT MANDATE CONVERSION TO METRIC.

THE 1978 GAO REPORT ON METRIC USE AND CONVERSION PROVIDES SUFFICIENT EVIDENCE OF THE DISADVANTAGES OF FORCED METRIC CONVERSION. WE DO NOT NEED ANOTHER EXPENSIVE STUDY OF THIS ISSUE AS PROPOSED IN H.R. 4490.

I URGE THE SUBCOMMITTEE TO REVIEW THE 1978 GAO REPORT, AND TO REJECT THE CALLS FOR YET ANOTHER STUDY OF METRIC CONVERSION. I ALSO URGE THE SUBCOMMITTEE'S EARLY ACTION ON THE LEGISLATION I INTRODUCED, H.R. 674, TO REPEAL THE METRIC CONVERSION ACT OF 1975 AND PREVENT FEDERAL GOVERNMENT INTRUSIONS NEEDLESSLY ADVANCED AS A RESULT OF THE 1975 LAW.

National Institute of
BUILDING SCIENCES

1015 Fifteenth Street, N.W.
Suite 700
Washington, D.C. 20005
(202) 347-5710

February 15, 1984

The Honorable Doug Walgren
Chairman, Sub-Committee on Science,
 Research & Technology
Committee on Science & Technology
2441 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Walgren:

This will refer to your February 7th Subcommittee hearing on the National Bureau of Standards Budget Authorizations. During the course of those hearings, there was some discussion of the National Earthquake Hazards Reduction Program (NEHRP) and the role played by the Federal Emergency Management Agency in the conduct of that program. We would like to take this opportunity to acquaint you with a very important and unique member of the earthquake hazard mitigation family -- the Building Seismic Safety Council, which is deeply engaged in the first task set forth in the National Earthquake Hazard Reduction Program Five-year Plan, FY 1983-87, submitted to the U.S. Congress by the Federal Emergency Management Agency, i.e., completion by 1985 of a set of recommended comprehensive seismic design provisions and their evaluation through trial designs, modification and eventual dissemination to the user community.

The Building Seismic Safety Council was established in 1979 as an independent, voluntary body under the auspices of the National Institute of Building Sciences in the furtherance of the Earthquake Hazards Reduction Act of 1977 (Public Law 95-124) and in support of the President's National Earthquake Hazards Reduction Program, June 22, 1978. The Institute derives its authority to do so from the Housing and Community Development Act of 1974 (Public Law 93-383), Title VIII, which brought the Institute into being.

The current membership of the Building Seismic Safety Council reflects the view of 57 professional organizations, trade associations, and government agencies deeply involved in the building community, and directly concerned with or affected by seismic design and regulation of buildings. In fact, the Council's principal resources are its strength and breadth of membership which is unique in three specific ways:

1. The depth and breadth of technical knowledge concerning earthquake behavior of structures, evaluating risks of damage, and of technical means for controlling damage.

2. The extensive understanding of the impacts of earthquake damage and regulatory measures available to mitigate such damage, with participation by all segments of society which are affected by such events, including technical people from both academic and professional practice, economic and commercial interests, societal interests, and representatives of governmental and regulatory bodies.

3. Substantial numbers of concerned individuals who contribute very extensive voluntary effort for the purpose of developing a substantial and viable consensus concerning available solutions to the earthquake mitigation problems.

Since its establishment just five years ago, the Council, with funding provided by the Federal Emergency Management Agency, has undertaken the trial design program recommended in the NEHRP Five-year Plan. The trial design program is large-scale, multi-phased and complex, and is directed toward the development of improved provisions for the design of seismic-resistant buildings. A brief summary of the Council's goals and purpose, and its trial design accomplishments to date, is attached, along with a listing of its member organizations and a copy of its Charter, Organizational Rules and Procedures.

We hope that your committee will share with the Institute and the Council the sense of importance of bringing to the NEHRP the variety of public and private interests essential to the program's success, and will accept the Council's offer to assist in any manner that it can.

The Institute and the Council appreciate the opportunity to submit its opinions to the subcommittee. We urge that Congress continue to support the work of the Council in accordance with the NEHRP Five-year Plan.

Thank you for considering our views.

Sincerely yours,

Rudard A. Jones Roy G. Johnston

Rudard A. Jones, FAIA
Chairman
Board of Directors

Roy G. Johnston
Chairman
Building Seismic Safety Council

THE BUILDING SEISMIC SAFETY COUNCIL

The Building Seismic Safety Council (BSSC) is an independent, voluntary body that was established under the auspices of the National Institute of Building Sciences (NIBS) in 1979 as a direct result of nationwide interest in the seismic safety of buildings. It has a membership of 57 organizations representing a wide variety of building community interests (see attachments).

The fundamental purpose of the BSSC is to enhance public safety by providing a national forum that fosters improved seismic safety provisions for use by the building community in the planning, design, construction, regulation, and utilization of buildings. To fulfill its purpose, the BSSC serves to:

1. Promote the development of seismic safety provisions suitable for use throughout the United States;
2. Recommend, encourage, and promote the adoption of appropriate seismic safety provisions in voluntary standards and model codes;
3. Assess progress in the implementation of such provisions by federal, state, and local regulatory and construction agencies;
4. Identify opportunities for improving seismic safety regulations and practices and encourage public and private organizations to effect such improvements;
5. Promote the development of training and educational courses and materials for use by design professionals, builders, building regulatory officials, elected officials, industry representatives, other members of the building community, and the public;
6. Advise government bodies on their programs of research, development, and implementation; and,
7. Periodically review and evaluate research findings, practices and experience, and make recommendations for incorporation into seismic design practices.

The BSSC's area of interest encompasses all building-type structures, and includes explicit consideration and assessment of the social, technical, administrative, political, legal, and economic implications of its deliberations and recommendations.

The BSSC believes that the achievement of its purpose is a concern shared by all in the public and private sectors; therefore, its activities are structured to provide all interested entities (e.g., government bodies at all levels, voluntary organizations, business, industry, the design profession, the construction industry, the research community, and the general public) with the opportunity to participate. The BSSC also believes that the regional and local differences in the nature and magnitude of potentially hazardous earthquake events require a flexible approach to seismic safety that allows for consideration of the relative risk, resources, and capabilities of each community.

The BSSC is committed to continued technical improvement of seismic design provisions, assessment of advances in engineering knowledge and design experience, and evaluation of earthquake impacts. The BSSC recognizes that appropriate earthquake hazard reduction measures and initiatives should be adopted by existing organizations and institutions, and incorporated, whenever possible, into their legislation, regulations, practices, rules, codes, relief procedures, and loan requirements so that these measures and initiatives become an integral part of established activities, not additional burdens. The BSSC itself assumes that standards-formulation organizations consider BSSC recommendations for inclusion into their documents and standards.

Since its inception, the BSSC initiated a multi-phased Trial Design Program directed toward the creation of an authoritative, technically sound resource document that can be used by the voluntary standards and model code organizations, the building community, and the public as the foundation for improved seismic safety design provisions for buildings. Funding for the first two phases has thus far been provided by the Federal Emergency Management Agency (FEMA).

The program focuses on the technical, societal, and economic implications of utilizing the Tentative Provisions for the Development of Seismic Regulations for Buildings, prepared by the Applied Technology Council (ATC).

Development of the Tentative Provisions was initiated in 1974 under a project funded by the National Science Foundation (NSF) and the National Bureau of Standards (NBS). The Tentative Provisions were published in June 1978; the authors realized that the Tentative Provisions included many innovations, and thus need careful assessment. The preface stated:

> "Because of the many new concepts and procedures included in these Tentative Provisions, they should not be considered for code adoption until their workability, practicability, enforceability, and impact on cost are evaluated by producing and comparing building designs for the various design categories included in this document."

As a consequence, during 1979 - 1980, NBS, in conjunction with the BSSC, and funding by FEMA, reviewed and assessed the Tentative Provisions. A total of nearly 100 individuals, divided into ten committees participated, representing industry, trade and professional organizations, and code-promulgating groups.

Numerous meetings and discussions were held, and correspondence exchanged, which resulted in over 300 proposed modifications or clarifications. Each of the proposed modifications were voted upon by all of the participants, and then submitted to ballot of the members of the BSSC. About 250 changes were adopted, while a number of others did not receive sufficient votes to be adopted. The adopted provisions were published by NBS and BSSC in December 1982 as "Amendments to ATC-3-06 Tentative Provisions for the Development of Seismic Regulations for Buildings."

Because of the intense interest in the Tentative Provisions, and controversy over some, a special committee was formed by BSSC to develop a plan for trial designs, using the provisions as amended. The committee was later appointed as a joint BSSC/NBS Trial Design Overview Committee, and later expanded to include additional expertise. The resulting program "Plan for a Trial Design Program to Assess Amended ATC-3-06 Tentative Provisions."

Meanwhile, in June 1982, FEMA provided funding to BSSC, through a contract with the National Institute of Building Sciences, for conduct of the first phase of the Trial Design Program. The objectives of the Trial Design Program are to:

1. Provide information for estimating the economic impact of changing from current practice to the amended ATC-3 provisions.
2. Evaluate the useability of the provisions insofar as designers, builders, and regulatory officials are concerned; especially relevance, clarity, completeness, and practicability.
3. Establish the technical validity of the provisions; in particular, some assurance they will enhance seismic safety.
4. Provide objective information for future resolution of disputes concerning specific provisions.
5. Provide results that are generally transferable to components, building types, and locations.

The first phase of the program involved testing the refined Tentative Provisions and generating preliminary data on design and construction time and costs through a process involving the design of 26 new buildings of various sizes and occupancies in four major cities with medium to high seismic risk (Los Angeles, Seattle, Phoenix, and Memphis). Design organizations were selected to prepare as a minimum two designs for each building: one, in accordance with local practice concerning seismic safety, and one, in accordance with the refined Tentative Provisions. The second phase, also funded by FEMA, is currently underway and involves a similar process, but focuses on the design of 20 new buildings in New York, Chicago, Charleston (South Carolina), Fort Worth, and Saint Louis. The designs are being subjected to initial technical and cost comparison and analysis, and a report of these preliminary findings will be prepared for FEMA. The program, including the Tentative Provisions, will be both modified to address any shortcomings uncovered during the first two phases, and expanded to include a third-phase thorough impact (technical, economic, and social) assessment. The basic program is being supplemented by voluntary efforts that will generate additional data.

August 1983

BUILDING SEISMIC SAFETY COUNCIL - MEMBERSHIP LIST

Organization	Representative	Alternate
AFL-CIO BLDG. & CONSTR. TRADES DEPT.	Jim E. Lapping	Robert A. Georgine
AMERICAN CONCRETE INSTITUTE	Samuel J. Henry	Frederic A. Nassaux
AMERICAN CONSULTING ENGINEERS COUNCIL	Warner Howe	Bruce E. Vogelsinger
AMERICAN COUNCIL OF INDEPENDENT LABORATORIES, INC.	Merlyn Isaak	
AMERICAN INSTITUTE OF STEEL CONSTR.	Geerhard Haaijer	James Marsh
AMERICAN INSURANCE ASSOCIATION	Michael Sbaglia	
AMERICAN IRON AND STEEL INSTITUTE	Roger H. Wildt	James C. Spence
AMERICAN PLYWOOD ASSOCIATION	Daniel H. Brown	
AMERICAN SOCIETY OF CIVIL ENGINEERS	Henry J. Degenkolb	Edwin Jones
APPLIED TECHNOLOGY COUNCIL	Roland L. Sharpe	Christopher Rojahn
ASSOCIATION OF ENGINEERING GEOL.	Ellis Krinitzsky	Reuben Kachadoorian
ASSOC. OF MAJOR CITY BLDG. OFFICIALS	Frank Kroeger	Robert Levy
ASSOC. GENERAL CONTRACTORS OF AMERICA	William A. Campbell	Christopher Monek
ASSOCIATION OF THE WALL & CEILING INDUSTRIES, INTERNATIONAL	Gene Erwin	Joseph A. Feldner
BRICK INSTITUTE OF AMERICA	Alan Yorkdale	Joseph A. Wintz, III
BUILDING OFFICIALS & CODE ADMINIS. INTERNATIONAL	Gerald H. Jones	Paul K. Heilstedt
BUILDING OWNERS & MANAGERS ASSOC. INTERNATIONAL	Neal D. Houghton	Elmer G. Johnston
CANADIAN NATIONAL COMMITTEE ON EARTHQUAKE ENGINEERING	S.M. Uzumeri	D.A. Lutes
CONCRETE MASONRY ASSOCIATION OF CALIFORNIA AND NEVADA	Stuart R. Beavers	
CONCRETE REINFORCING STEEL INSTITUTE	Paul F. Rice	
CONTRACT SERVICES ADMINISTRATION TRUST FUND	Terrill McGee	

BSSC MEMBERSHIP LIST

Organization	Representative	Alternate
COUNCIL OF AMERICAN BUILDING OFFICIALS	Vincent R. Bush	James E. Bihr
EARTHQUAKE ENGINEERING RESEARCH INSTITUTE	William W. Moore	LeRoy Crandall
INTERAGENCY COMMITTEE ON SEISMIC SAFETY IN CONSTRUCTION	Richard D. McConnell	Richard Wright
INTERNATIONAL CONFERENCE OF BLDG. OFFICIALS	D.R. Watson	John Nosse
MASONRY ADVISORY AND TECHNICAL INST.	Donald A. Preble	
MASONRY INSTITUTE OF AMERICA	James E. Amrhein	
MASONRY INSTITUTE OF WASHINGTON	T.A. Stover	
METAL BUILDING MANUFACTURERS ASSN.	William Sontag	Duane S. Ellifritt
NATIONAL ASSOCIATION OF HOME BUILDERS	Richard Morrison	
NATIONAL ASSN. OF HOUSING AND REDEVELOPMENT OFFICIALS	Bernard Cummings	
NATIONAL FIRE SPRINKLER ASSN.	William R. Goss	Russell P. Fleming
NATIONAL CONCRETE MASONRY ASSOCIATION	Mark B. Hogan	Kevin D. Callahan
NATIONAL CONFERENCE OF STATES ON BUILDING CODES & STANDARDS, INC.	Donald F. Pinkerton	
NATIONAL ELEVATOR INDUSTRY, INC.	Ralph Rogers	George N. Gibson
NATIONAL FOREST PRODUCTS ASSOCIATION	Thomas E. Brassell	Roderick B. Buchan
NATIONAL INSTITUTE OF BUILDING SCIENCES	Charlene F. Sizemore	
OKLAHOMA MASONRY INSTITUTE	Paul LaVene	
PORTLAND CEMENT ASSOCIATION	W. Gene Corley	Mark Fintel
PRESTRESSED CONCRETE INSTITUTE	Daniel P. Jenny	David A. Sheppard
RACK MANUFACTURERS INSTITUTE	Victor Azzi	William A. Hakanson
SOIL AND FOUNDATION ENGRS. ASSN.	R. Leonard Allen	

BSSC Membership List

Organization	Representative	Alternate
SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL	Billy R. Manning	Gary W. Walker
STEEL PLATE FABRICATORS ASSN. INC.	Jimmy D. Fretz	Earl A. Bratton
STRUCTURAL ENGINEERS ASSN. OF ARIZONA	Uno Kula	
STRUCTURAL ENGINEERS ASSN. OF CALIFORNIA	Ajit S. Virdee	Thomas Wosser
STRUCTURAL ENGINEERS ASSN. OF CENTRAL CALIFORNIA	John Schroeter	Hugh P. Campbell
STRUCTURAL ENGINEERS ASSN. OF NORTHERN CALIFORNIA	Robert J. Bentson	Ephraim G. Hirsch
STRUCTURAL ENGINEERS ASSN. OF SAN DIEGO	Richard V. Stage	Melvyn Mark
STRUCTURAL ENGINEERS ASSN. OF SOUTHERN CALIFORNIA	Hans Steinmann	Walter Saunders
STRUCTURAL ENGINEERS ASSN. OF UTAH	Lawrence D. Reaveley	Newland Malmquist
STRUCTURAL ENGINEERS ASSN. OF WASHINGTON	Skip Bush	Bruce C. Olsen
THE AMERICAN INSTITUTE OF ARCHITECTS	Christopher Arnold	John Fisher
THE MASONRY SOCIETY	George C. Hanson	
UNIT MASONRY ASSN. OF SAN DIEGO, INC.	Walter L. Dickey	David L. Shepersky
WESTERN STATES COUNCIL STRUCTURAL ENGINEERS ASSOCIATION	Harry H. Mejdell	William T. Rafferty
WESTERN STATES CLAY PRODUCTS ASSN.	Donald Wakefield	

Affiliate Member

CALIFORNIA DYNAMICS CORPORATION	Donald Benkert	
SOCOTEC, U.S.A. CORPORATION	James K. Grant,	Michael Maglaras

BUILDING SEISMIC SAFETY COUNCIL

CHARTER

ORGANIZATIONAL RULES AND PROCEDURES

ARTICLE I. CHARTER

Section 1. Purpose and Scope

The purpose of the Building Seismic Safety Council (Council) is to enhance the public's safety by providing a national forum to foster improved seismic safety provisions for use by the building community. For the purposes of the Council, the building community is taken to include all those involved in the planning, design, construction, regulation, and utilization of buildings.

The scope of the Council's activities encompasses seismic safety of building-type structures with explicit consideration and assessment of the social, technical, administrative, political, legal, and economic implications of its deliberations and recommendations.

Achievement of the Council's purpose is a concern shared by all in the public and private sectors. Council activities will provide an opportunity for participation by those at interest, including local, State, and Federal Government, voluntary organizations, business, industry, the design professions, the construction industry, the research community and the public. Regional and local differences in the nature and magnitude of potentially hazardous earthquake events require a flexible approach adaptable to the relative risk, resources and capabilities of each community.

The Council recognizes that appropriate earthquake hazard reduction measures and initiatives should be adopted by existing organizations and institutions and incorporated into their legislation, regulations, practices, rules, codes, relief procedures and loan requirements, whenever and wherever possible, so that these measures and initiatives become part of established activities rather than being superposed as separate and additional.

Section 2. Establishment and Duration

The Council is established as an independent, voluntary body under the auspices of the National Institute of Building Sciences (Institute).

Section 3. Statutory Authority

The Council is established under the authority of the Housing and Community Development Act of 1974, (Public Law 93-383), Title VIII, which established the Institute, in furtherance of the objectives of the Earthquake Hazards Reduction Act of 1977 (Public Law 95-124), and in support of the President's National Earthquake Hazards Reduction Program, June 22, 1978.

Section 4. Objectives

To achieve its purpose, the Council shall:

a. promote the development of seismic safety provisions suitable for use throughout the United States;

b. recommend, encourage, and promote the adoption of appropriate seismic safety provisions in voluntary standards and model codes;

c. assess implementation progress by Federal, State, and local regulatory and construction agencies;

d. identify opportunities for the improvement of seismic regulations and practices and encourage public and private organizations to effect such improvements;

e. promote the development of training and educational courses and materials for use by design professionals, builders, building regulatory officials, elected officials, industry representatives, other members of the building community and the public.

f. provide advice to governmental bodies on their programs of research, development, and implementation; and

g. periodically review and evaluate research findings, practice, and experience and make recommendations for incorporation into seismic design practices.

ARTICLE II. MEMBERSHIP

Section 1. Qualifications

The membership of the Council is open to all professional societies, and labor, trade, model code, voluntary standards, public interest, and public agency organizations which have an interest in the Council's purpose. Organizations not meeting these requirements, but nonetheless interested in pursuing the purpose and objectives of the Council may petition and be elected to membership by the Board of Direction (Board). The Council will make a reasonable effort to create and maintain a membership that is a broad and balanced representation of all segments of the building community and the public interest.

Section 2. Admission of Members

Qualified organizations will be admitted as members upon filing a completed Membership Application with the Secretary of the Council and approval by the Board of Direction. Member organizations will designate a representative and an alternate authorized to act on behalf of the organization. Any change in the authorized representative or alternate will be accomplished by filing a notice of such change with the Secretary.

Section 3. Rights of Members

Each member shall be entitled to one vote on all matters brought before the Council, and shall receive notice of meetings, minutes of such meetings, and other appropriate documentation of the affairs of the Council. Each person serving on any committee, panel, or other unit of the Council shall be entitled to one vote on all matters before that unit. Alternates of representatives elected to the Board are not authorized to act on matters coming before that body. Any change in the authorized representative or alternate will be accomplished by filing a notice of such change with the Secretary.

Section 4. Removal of Members

Members may be removed at the discretion of 2/3 of the Board after failure to participate in the activities of the Council.

Section 5. Affiliates

Affiliates shall be those organizations and individuals desiring notification of Council activities and meetings and wishing to receive information supplied by the Council to its members. Affiliates shall not be entitled to vote on Council business.

ARTICLE III. CONDUCT OF COUNCIL BUSINESS

Section 1. Policy

The business of the Council and its subunits shall be conducted in accord with the policies, rules, and procedures established by vote of the members of the Council.

Section 2. Meetings

The Council shall hold at least one meeting annually that shall be designated as its annual meeting. The annual meeting shall be held preferably during November of each year with at least thirty (30) days notice. Other meetings will be called by the Chairperson of the Council upon at least fifteen (15) days written notice to all members. These meetings shall be called by the Chairperson upon majority vote either of the Council or its Board or by petition of at least twenty (20) percent of the members, with the same notice.

Section 3. Rules of Order

"Roberts' Rules of Order" shall govern the transaction of all business before the Council.

Section 4. Quorum

A quorum for conduct of the Council's business shall be at least one-third (1/3) of the members of the Council. The lack of a duly constituted quorum shall not preclude those in attendance from conducting Council business provided that the minutes are confirmed by mail by the Council in accord with the requirements for mail ballot.

Section 5. Voting

See Articles IV, V, and VI for the procedures for the election of the Board, Officers, and Nominations Committee.

Section 5. Voting (Cont'd.)

All matters submitted to a vote during meetings of the Council shall be considered passed if a simple majority of those present vote in favor. Mail ballots to the full membership of the Council shall be required in the following instances:

a. All amendments to Rules and Procedures (see Article XI).

b. All matters petitioned by ten (10) members. A voice or written vote for mail ballot on a matter during a regular meeting by ten (10) members shall be considered an acceptable petition for mail ballot.

c. All matters called for by a simple majority of the Board.

When a mail ballot is called for, the following shall apply:

a. Ballots shall provide four alternatives: Yes; Yes with reservations; No; and, Not voting. "Yes with reservations" and "No" votes must be accompanied by full and sufficient basis for the vote. A "No" vote should be accompanied by specific suggestions for change, if those changes would change the negative to affirmative.

b. Closing date shall be thirty (30) days after date mailed.

c. Ballots shall be reviewed and counted by a Tellers Committee appointed by the Chairperson, which shall attempt to resolve all "Yes with reservations" and "No" votes. All such votes and accompanying basis for the vote shall be distributed to the full voting membership.

d. A two-thirds (2/3) affirmative ("Yes" and "Yes with reservations") vote of those received by the closing date shall be sufficient to record a favorable vote, provided at least one half of the member's ballots are returned.

e. All votes and supporting materials shall be filed with the Secretary of the Council.

The results of votes by the full Council shall not be considered binding on organizations participating as members of the Council, but shall be binding with respect to the business of the Council.

Section 6. Minutes and Annual Report

Minutes shall be kept of all meetings of the Council and its constituent groups and shall be approved by the members attending the meetings. Approved minutes shall be filed with the Secretary of the Council. The Secretary shall submit a written annual report to the membership following the close of the fiscal year and not later than at the ensuing Annual Meeting.

ARTICLE IV. BOARD OF DIRECTION

Section 1. Duties and Responsibilities

The Board shall: a) administer the affairs of the Council in accordance with policy as approved by the Council; b) explore matters and initiate and carry out all activities within the Council's sphere of interest; c) assign responsibility to the senior staff officer, all committees, panels, and other units of the Council necessary to the conduct of the Council's business; d) review and approve for public release all reports and other documents containing findings, conclusions, and recommendations of the Council; e) approve the terms and conditions of all contracts on behalf of the Council; and f) approve applications for Council membership.

Section 2. Membership

The Board shall consist of not less than nine (9), nor more than fifteen (15) elected persons, plus a Chairperson. The Board members will be individuals selected from the designated representatives of the membership of the Council. The Chairperson shall be selected by the Board.

An interim Board will be appointed by the Institute to serve until the first Annual Meeting of the Council with due consideration to providing broad representation and balance from all segments of the building community and the public interest.

Membership of all succeeding Boards also shall be broadly representative of all segments of the building community and the public interest.

At any time a Board member other than the Chairperson ceases to be the representative of his or her organization, the member shall be deemed to have resigned from the Board.

Section 3. Terms

The term of members of the first elected Board shall be chosen by lot, with one-third for a term of one (1) year, one-third for a term of two (2) years, and one-third for a term of three (3) years. Thereafter, one-third of the members will be elected annually for a term of three (3) years. No individual shall serve for more than six (6) successive years.

Section 4. Vacancies

Vacancies may be filled by the Board until the next annual meeting, at which time an election shall be held to fill the unexpired term.

Section 5. Recall

Any member of the Board can be removed by simple majority vote of the Council's membership, upon petition by twenty (20) per cent of the members of the Council.

Section 6. Meetings

The Board shall hold at least three (3) other meetings in addition to a meeting in conjunction with the Annual Meeting of the Council. Other meetings may be called by the Chairperson, upon majority vote of the Board, or upon written request of a majority of the Board, with ten (10) days' written notice.

Section 7. Quorum

A quorum for conduct of the business of the Board shall be a simple majority.

ARTICLE V. OFFICERS

Section 1. Officers

The officers of the Board, who also shall be the officers of the Council, shall be the Chairperson, the Vice Chairperson, and the Secretary. The Treasurer and Comptroller of the Institute shall function as non-voting officers in these capacities for the Council.

Section 2. Selection of Officers

The Chairperson shall be selected by majority vote of the Board from individuals who are not necessarily the designated representatives of member organizations. For purposes of the Council, the Chairperson is a member of the Council but shall not be the representative or alternate of any specific member organization during his term of office. The Vice Chairperson and Secretary shall be selected by majority vote of the Board from among its members.

Each such officer shall hold office until a successor shall have been duly elected and qualified, or until resignation or removal by the Board.

Section 3. Terms

The Chairperson, Vice Chairperson, and the Secretary shall serve at the pleasure of the Board for a term of one (1) year beginning immediately following the Annual Meeting. No individual shall serve in any one office for more than two consecutive one (1) year terms. Vacancies shall be filled for any unexpired term by the Board.

The Treasurer and Comptroller shall serve for terms consistent with their tenure in the same office in the Institute.

Section 4. Duties and Responsibilities

The duties and responsibilities of officers shall be as follows:

a. Chairperson - The Chairperson shall serve as the Chief Executive Officer and principal spokesperson for the Council, and preside at all meetings of the Board and of the Council. The Chairperson shall appoint, in counsel with the Board, all committees, panels and other units of the Council and verify the review and approval of all reports and other documents for public release on behalf of and with the approval of the Board.

b. Vice Chairperson - The Vice Chairperson shall act for the Chairperson in all respects during the temporary absence of the Chairperson.

c. Secretary - The Secretary shall: 1) see that all notices of meetings are duly given; 2) keep or cause to be kept all books, minutes, and other records of the activities of the Council and its Board as are required by law or by these Rules and Procedures; 3) sign such instruments as require the signature of the Secretary; and 4) in general, perform all duties incident to the Office of Secretary and such other duties as from time to time may be assigned by the Chairperson or the Board.

d. Treasurer - The Treasurer shall: 1) have charge and custody of, and be responsible for, all funds of the Council; 2) receive, and give receipts for, monies due and payable to the Council; 3) sign such documents as shall require the signature of the Treasurer; and 4) in general perform all the duties incident to the Office of Treasurer.

e. Comptroller - The Comptroller shall: 1) be the chief accounting officer of the Council; 2) keep full and accurate accounts of all assets, liabilities, commitments, receipts, disbursements, and other financial transactions of the Council; 3) cause regular audits of the books and records to be made; 4) see that all expenditures are made in accordance with procedures duly established, from time to time, by the Council with the concurrence of the Institute; 5) render financial statements at all regular meetings of the Council Board if called upon to do so, and a full financial report at the Annual Meeting of the Council; and 6) in general, perform all the duties ordinarily connected with the Office of Comptroller.

ARTICLE VI. NOMINATIONS COMMITTEE

Section 1. Functions

The Nominations Committee shall annually, at least sixty (60) days prior to the Annual Meeting, submit to the Secretary of the Council a balanced slate of candidates broadly representative of all segments of the building community, for election to the Board, equal to the number of vacancies to be filled. They shall also submit a slate of at least seven (7) nominees for the next Nominations Committee. In drawing-up a slate, the Nominations Committee shall first solicit recommendations from the full membership of the Council.

Section 2. Membership

The Nominations Committee shall be composed of the five (5) nominees receiving the greatest number of votes, none of whom shall be members of the Board, nor the prior Nominations Committee. They may not nominate themselves for election to the Board or the next Nominations Committee.

Section 3. Terms

The term of the Nominations Committee shall begin prior to June 1 of each year and shall expire with the Annual Meeting.

Section 4. Processing of Nominations

The Secretary shall submit the slate of candidates from the Nominations Committee, with space for write-in candidates, to ballot by the full membership of the Council at least forty-five (45) days prior to the Annual Meeting. Executed ballots must be received by the Secretary at least fifteen (15) days prior to the Annual Meeting. Upon receipt of ballots, the Secretary, in concert with a Tellers Committee, shall tally the ballots, determine those elected to the Board on the basis of the largest vote, and present the vote to the Board for announcement at the Annual Meeting. In case of a tie vote that will affect the Board's composition, the Board shall fill the disputed vacancy from among the tied candidates with due regard to maintaining a balanced representation of all segments of the building community on the Board.

ARTICLE VII. COMMITTEES

Section 1. Operations

Committees shall function under written rules and procedures approved by the Board.

Section 2. Term

The Board, by majority vote, may create and terminate such committees as it deems appropriate.

Section 3. Membership

Membership on other than administrative committees need not be restricted to members of the Council.

Section 4. Publications

Reports and other documents of all committees that are intended for public release as reports of the Council must be reviewed and approved by the Board prior to publication.

ARTICLE VIII. FINANCIAL AFFAIRS

Section 1. Grants, Contracts, and Donations

The Institute, on behalf of the Council, may receive grants, contracts, and donations, and may execute contracts, grants and other appropriate agreements that are approved by the Board.

Section 2. Membership Fees

The Council may establish membership fees, and may waive these fees for particular members. The Chairperson shall not be assessed a membership fee.

Section 3. Funds

Accountability and administration of all income and other revenues designated for support of the Council or its activities shall be the responsibility of the Institute. Such funds shall be used only to defray expenses of the Council authorized by its Board. Overhead costs of the Institute will be charged at a rate equal to that charged on other program income of the Institute. The Institute shall maintain separate accounting for the business of the Council and render an annual financial report and such other financial reports at such times as may be requested by the Council or its Board.

Section 4. Fiscal Year

The fiscal year of the Council shall be the same as that of the Institute.

ARTICLE IX. STAFF

Section 1. Support Staff

The Institute shall arrange for administrative services and support staff requested by the Board. The selection, duties, responsibilities, and title of the senior staff officer shall be determined by the Board. The Council shall not retain or cause to be retained, permanent technical staff.

Section 2. Technical Consultants

Technical Consultants to the Council, will be retained by the Institute as requested by the Council, consistent with its budget. Such consultants shall be selected and, where necessary, terminated with the concurrence of the Board.

ARTICLE X. ADOPTION

The Council shall be considered to be formed upon adoption of this Charter and these Organizational Rules and Procedures by a two-thirds (2/3) majority of the representatives of organizations attending and voting at the organizational meeting. Thereafter, this Charter and these Organizational Rules and Procedures shall govern affairs of the Council, subject to the provisions of Article XI.

ARTICLE XI. AMENDMENTS

Proposed amendments to any article may be offered by a written petition by twenty (20) percent of the members of the Council or by majority vote of the Board. Proposed amendments will be reviewed by the Institute to certify their compliance with statutes referenced in Article I, Section 3. prior to submission to membership for ballot. The Secretary of the Council shall cause such duly authorized proposed amendments to be submitted to the full membership for written ballot at least forty-five (45) days prior to the next Annual Meeting or special meeting called for that purpose. Votes received at least fifteen (15) days prior to the meeting shall be tallied by the Secretary in accordance with procedures established

STATEMENT CONCERNING THE FEDERAL FIRE PREVENTION AND CONTROL PROGRAMS

submitted to the

Subcommittee on Science, Research and Technology
Committee on Science and Technology
United States House of Representatives

by the

National Fire Protection Association
Batterymarch Park
Quincy, Massachusetts 02269

February 7, 1984

Part I

The National Fire Protection Association (NFPA) supports the reauthorization of the Fire Prevention and Control Act of 1974. In providing support for the reauthorization of this Act and the activities of the United States Fire Administration (USFA) and the National Fire Academy, the NFPA provides the following brief background concerning the Association.

The NFPA, founded in 1896, is a nonprofit, technical and educational membership organization. It has remained the principal public advocate for fire safety since its inception. The Association's membership of over 32,000 is drawn from the many disciplines involved in, and concerned about, the national fire problem. NFPA is not a trade or industry association. No one group or interest is dominant. The only common membership denominator is a concern about fire safety. Members include fire service personnel, fire marshals, electrical inspectors and city managers; architects, engineers and educators; health care facility operators and similar groups from commerce, industry, insurance and the Federal Government.

One of the principal functions of NFPA is the development of more than 200 consensus codes and standards related to fire protection. They range from the Life Safety Code through the National Electrical Code, the National Fuel Gas Code and flammable liquids standards, sprinkler and similar equipment standards to those used for fire apparatus, fire fighter safety and professional qualifications. NFPA has many other functions including public education, technical advisory services, research and development, and data collection and analysis.

The NFPA is a founding member of the Joint Council of National Fire Service Organizations (JCNFSO) which has been a prime mover in getting and sustaining a federal focus on fire.

Part II

The NFPA has provided testimony or statements for the record in support of the United States Fire Administration at all of its authorization and appropriation hearings. NFPA has been a strong supporter of the need for the United States Fire Administration and an effective federal involvement in resolving this Nation's fire problems. The NFPA would like to indicate to the Committee its support and approval for the present leadership and direction provided by the Federal Emergency Management Agency. Some of the achievements of the United States Fire Administration are:

- Development of cooperative programs which, in the intent of the enabling legislation, work with existing organizations already well established within the national fire community, taking advantage of the activities of these existing efforts and avoiding duplication.
- In recognition that fire is very much a state and local problem, by supporting and assisting state and local programs in areas for which local resources are limited, or where federal resources are the most effective way to deal with the problem.
- Maintaining the thrust, intent and purposes of the Federal Fire Prevention and Control Act of 1974.
- Placing emphasis on programs dealing with solutions to the everyday community fire problems.

- Continued and highly effective programs of the National Fire Academy and giving these programs the highest priority necessary in relation to the magnitude of the national fire problem. The Academy has always been a major priority with NFPA.

The NFPA desires to compliment FEMA on its recognition of the capabilities of ongoing programs at the state and local level, as well as within the private sector. The Federal Emergency Management Agency has initiated cost-effective, cooperative programs with state and local agencies and other organizations in the true intent of the Fire Prevention and Control Act.

NFPA is encouraged by the direction being taken by the Federal Emergency Management Agency and feels that even more involvement and usage of ongoing programs can ultimately benefit the objectives of the Fire Prevention and Control Act of 1974. As the Nation's principal public advocate for fire safety, the NFPA strongly supports the programs of the United States Fire Administration and the National Fire Academy as provided for in the FY'85 budget under consideration.

Part III

The 1974 Act amended the generic act of the National Bureau of Standards (15 USC 278) to provide for the Fire Research Center at NBS.

We wish to express very serious concern about the future of that establishment. In the Administration's budget for FY '84 there was a zero funding for the Center. Your Committee and the Appropriations Committee restored funds which finally equated the FY '83 level. This was obviously a holding pattern and NFPA greatly appreciated the support Congress gave.

However, the Administration's FY '85 Budget again shows zero funding for the Center for Fire Research and we cannot help wondering how long this fight must continue.

Congress very clearly indicated that fire research by the Center was an important part of the purposes of the Act and necessary to reduce the debilitating effect on the nation's well-being, both in terms of wealth and resources, as well as human suffering.

Since the Act was put into effect, the Center has performed admirably in the role articulated at that time.

The Center has executed many programs of research that have contributed to better control and reduction of the fire problem.

Without going into the litany of these programs, which we submitted to you last year in a lengthy paper on the Center for Fire Research, we would like to point out that scientific and technological research and development has brought means of dealing with the fire problem to us that never were available before.

I refer to the availability of new state-of-art measurement and electronic analysis, which not only enables almost every aspect of fire behavior and the reasons for its erratic and variable growth to be broken down into hitherto unidentifiable components, but also for electronic modeling to be used to provide predictions of fire occurence, growth, and the effect on materials that could eventually change the whole approach to eradication of fire as a threat by prevention and control.

The Center for Fire Research is at the core of this progress and the possibility of an abrupt end to this is not only appalling but also, in our opinion, criminal. The ripple effect on those outside the Center would be such that academic and scientific fire research work would slow down and possibly stop. The transfer of technology that also stems from the work of the Center would cease.

In an age when research and development is moving ahead in most areas, when we are beginning to see results from new technology in fire control, we fail to see the logic behind the move to eliminate fire research.

We recognize the need for restraint in Federal spending, but when we see lives being lost, hundreds of thousands of disfiguring burns, and billions of dollars of our national wealth reduced to ashes, we find it hard to accept that the 8 to 10 million dollars needed for federal fire research is not worthwhile.

In fact, both in terms of lives saved and property preserved, it is a good investment and certainly will be a cost-effective use of funds.

We have indicated that technology has brought us to the threshold of a new and meaningful attack on the fire problem; we would like to point out just a few examples of key programs of the Center that will lead to very effective solutions:

SMOKE HAZARD ASSESSMENT - This is a multi-faceted program which addresses not only the toxicity of products of combustion but also the movement of the lethal gases in buildings. The CFR work can and will, if continued, ultimately enable a prediction of the hazard in various parts of buildings, even those remote from the immediate fire, and also estimate the time it would take for the building atmosphere to become dangerous to occupants.

The significance of this might not be readily apparent to the layman, but if one recalls some recent fire disasters, it should be easily recognized how critical this information is to building designers, developers, and to code enforcers. And how much more critical it is to those whose lives might be saved by improved design and fire control measures.

FAST-ACTING SPRINKLER SYSTEMS - Over 100 years ago the sprinkler system was introduced and since has more than justified the moderate cost of installation. These systems were generally considered to be for property protection despite the fact that the life safety record in sprinklered buildings has been consistently good.

Recent changes in response time and performance of sprinklers, done mainly to create a low-cost residential system for homeowners, have indicated that the fast-response sprinkler could have a vastly increased life safety role, not only in homes, but any type of occupancy. It might perhaps be the answer to many other fire safety problems. The CFR work on the relationship of the fast-response spinkler to life safety is of vital importance to everyone.

The fact that the technology is now emerging to reduce life loss and materially reduce cost of fire protection at the same time is alone sufficient to justify the continuation of this program.

BUILDING CONTENTS CONTRIBUTION TO FIRE HAZARD - Most safety precautions in fire control have been based on the structure of buildings and in-built protective features. But in almost every fire that occurs, it is the contents of the building that initially ignite and continue to burn creating the smoke and toxic gases that trap and kill the occupants. This has been known for hundreds of years but due to the multiplicity of materials, design, placement and the daily variations that occur in the disposition of contents, it has never been considered very practical to try to cope with this other than in a limited way. With the advent of many new materials, the problem has been compounded.

The CFR is now involved in a program that is expected to lead to methodologies of measuring and modeling contents on a scale that has not been possible before. It should lead to ways of analyzing the effect of building contents when involved in fire that can be translated into practical and applicable formulae for all involved in the design and use of buildings of all categories. There is much work that needs to be done in this area and it is not going to be an easy task but the CFR is the obvious place for the initial research to be carried out.

While these three programs are not the only ones of major importance and that offer solutions, they are good examples of the direction fire research at the Center is taking. These directions are essential, realistic, and are taking full advantage of modern technology. Many of these also involve the Center for Building Technology which has an important and synergistic role with the Center for Fire Research.

We urge that every possible effort be made to preserve and continue the Center for Fire Research and to provide adequate funding for the work that is so necessary to an effective reduction in the United States fire losses.

IMPACT ON U.S. FIRE EFFORTS OF PROPOSED CUT-OFF OF BASE FUNDS FOR THE NBS CENTER FOR FIRE RESEARCH

1. THE ONLY COMPREHENSIVE RESEARCH PROGRAM DIRECTED AT REDUCING FIRE DEATHS AND INJURIES WILL DISAPPEAR. This research is paying off. Since 1976, the U.S. fire loss record has improved more than any other industrialized nation. Yet, the U.S. still has one of the worst fire death rates in the world, almost twice that of most other nations. Each year fires result in 7600 deaths, almost 300,000 injuries, and $6.5 billion in direct property losses. As a result of this cut, the Center for Fire Research (CFR) will disappear, leaving the U.S. the only major industrialized nation without a Federal Fire Research Laboratory.

2. FUNDAMENTAL RESEARCH NEEDED TO SUPPORT THE PRIVATE SECTOR IN REDUCING THE COSTS OF FIRE PROTECTION WILL END. The cost of providing fire suppression forces and built-in fire protection for buildings exceeds $20 billion annually. The Center's fundamental fire research is directed toward reducing fire protection costs as well as direct loss reduction through better understanding of fire growth, improved codes and standards and less redundancy in fire protection. A 50% reduction in this level appears feasible.

3. MOST OF THE FUNDAMENTAL RESEARCH ON FIRE AT U.S. UNIVERSITIES WILL STOP. Since 1976, the Center has supported nearly all such fire research programs after taking over the former National Science Foundation Fire Research Program. The program consists of about 30 grants for $1.5-$2.0 million annually and supports most of the advanced training of fire scientists in the country. Universities receiving grants at present include Harvard, Cal Tech, Berkeley, Princeton, Notre Dame, Brown, Northwestern, Maryland, Clemson, Florida, Massachusetts, Michigan, Pittsburgh, Montana, Penn State, Case Western, and Washington.

4. THE FLOW OF NEW FIRE SAFETY TECHNOLOGY FOR BUILDINGS WILL BE REDUCED. The Center operates major programs on sprinklers, smoke control, smoke detection, and building design, all of which will be discontinued. All these programs deal with the fundamental processes involved, and the development of new knowledge and predictive capabilities. Industry uses this information for technology development.

5. THERE WILL BE LITTLE FURTHER WORK ON COMBUSTION PRODUCT TOXICITY, WHICH ACCOUNTS FOR 80 PERCENT OF ALL FIRE DEATHS. The Center supports most of the U.S. research in this area. There are still no accepted means for measuring, interpreting, or reducing the toxic effects of fire. The Congressionally directed toxicity research at NBS will be terminated.

6. RECENT HIGH LOSS-OF-LIFE FIRES (WESTCHASE HILTON, TEXAS: BILOXI JAIL FIRE, MISSISSIPPI: BEVERLEY HILLS SUPPER CLUB, KENTUCKY) UNDERSCORE THE INADEQUACY OF EXISTING FIRE TESTS; BADLY NEEDED NEW FIRE TESTS WILL NOT BE AVAILABLE. New methods for flame spread and heat release are necessary to cope with the very different burning behavior of some plastics and other new materials. The Center is the principal laboratory for the development of these methods, typically involving technical interchange with industry, often in the form of industrial research associates, and guest workers from counterpart laboratories overseas; for example, from Canada, Japan, China, England and France.

7. IMPORTANT COST-SAVING OPPORTUNITIES IN FIRE-SAFE BUILDING DESIGN WILL BE MISSED. Fire safety equivalency systems for hospitals, developed by the Center, have recently saved the healthcare industry millions of dollars. The Center will be unable to pursue plans to develop such systems for other building types.

8. FIRE PROTECTION OFFICIALS AND INDUSTRY WILL LOSE THE ONLY CENTRAL U.S. FIRE RESEARCH LABORATORY. The Center provides laboratory work and technical assistance to over 100 standards-writing and code committees engaged in fire protection. None of these have laboratory facilities or technical staffs. CFR fire test and test method development facilities have provided important and continuing services to industry and other agencies of government for over 70 years.

9. RESEARCH TO IDENTIFY AND RESPOND TO SERIOUS NEW SOURCES OF FIRE LOSS WILL BE NONEXISTENT. New materials and products often introduce new hazards into buildings. For example, in just the last three years in several regions of the U.S., home heating fires have replaced smoking materials as the largest single source of residential fire loss. CFR research identified this problem and is already providing data and test methods to deal with it.

10. HALTING RESEARCH ON METHODS TO PREDICT FIRE GROWTH WILL PREVENT INTRODUCTION OF COMPUTER-BASED FIRE SIMULATORS for designers, code officials, fire service officers, and fire fighters. CFR in-house and grant research is providing the knowledge base needed for effective simulations.

11. FUNDAMENTAL RESEARCH AND PROGRAMS WHICH SUPPORT OTHER FEDERAL AGENCIES AND STATE AND LOCAL GOVERNMENTS WILL BE ELIMINATED. CFR in-house and grant research provides the knowledge base used by many other Federal, State and Local agencies in their applied research efforts to reduce fire risks and losses, analyses of cost effectiveness of safety requirements, and fire protection programs. Affected Federal agencies include the Departments of Health and Human Services, Transportation, Interior and Defense.

2/10/83

Facilities of the Center for Fire Research

The Center for Fire Research (CFR) occupies the following facilities at the NBS Gaithersburg Laboratories.

Building 224

The Center occupies approximately one-third of this three-story general purpose laboratory. The CFR laboratories were remodeled in 1980 at a cost in excess of $2.0 million to provide improved smoke control and smoke abatement equipment and other safety features to adapt the building to fire research. Units housed in this building include:

Administrative Offices
Fire Research Information Services
Basic Fire Research Laboratory
Fire Modeling and Computer Laboratory
Fire Risk Analysis Laboratory
Fire Toxicology Laboratory
Building Fire Safety Performance Laboratory
Material Fire Property Laboratory
Fire Suppression Laboratory
Smoke Laboratory

Building 205

This building, completed in 1974 at a cost of more than $1.5 million, was designed specifically for the large scale fire experiments and tests conducted by the Center. Smoke abatement equipment permits large fires to be conducted safely and without polution of the environment. Major experimental units in the building include:

Room-Corridor Burn Facility
Large Fire Endurance Furnace
Rate of Heat Release Laboratory
Flame Spread Laboratory
Room Fire Test Facility
Toxicity Test Laboratory

NBS Annex

The Center uses several existing buildings at this former Nike missile site near the main Gaithersburg Laboratories. The annex serves as a field station for ad-hoc experiments not readily accommodated in the main laboratories. Typical activities include:

Fire Tests of Mobile Homes
Studies of Smoke and Gas Movement in Buildings
Smoke Control System Studies
Tests of Sprinkler Activation and Effectiveness
Fire Detector Siting and Performance Studies
Fire Spread Studies

The Center interacts extensively with other technical units located at NBS, particularly the Center for Applied Mathematics, the Center for Building Technology, the Center for Chemical Engineering, the Center for Analytical Chemistry, and the Center for Materials Science. The special expertise available in these Centers contributes substantially to the strength of the CFR technical program.

The Center also draws heavily on the administrative support services available at NBS, particularly the Library, Instrument Shops, Personnel, Procurement, Publications, and Maintenance Services. The availability of these supporting services contributes greatly to the efficiency of the Center's operation.

Recent and Current Accomplishments of the Center for Fire Research

The Center for Fire Research (CFR) at the National Bureau of Standards provides the principal focal point for fire research in the United States and coordinates the nation's effort in this field with international fire research activities. The goal of the Center's program is to provide the scientific and technical base for reducing fire loss and the cost of fire protection. The following activities contribute to the achievement of these objectives.

- The Center's in-house research program is the most comprehensive fire research program in the world. It provides the basic capability in staff, facilities, and expertise to enable us to respond to industry, fire and code officials, and to the mission-oriented fire safety needs of federal, state, and local agencies.

- A Fire Research Grants Program enlists the participation of outstanding academic scientists and supports and encourages the training of young scientists and engineers in fire research and safety.

- Extensive interactions with Fire Protection Engineering organizations, the Fire Services, and material and product suppliers assure that our program is relevant to real world fire problems and that the results of our research find practical use.

- Cooperation with the international fire research community through joint research programs, exchange of guest workers, and participation in international conferences provides a synergistic effect resulting from the free exchange of information and ideas.

- Extensive participation in the voluntary standards organizations provides an effective mechanism for introducing the results of the Center's research findings into the voluntary standards system and subsequently into building codes and regulations.

- A Fire Research Information Service maintains the most comprehensive collection of fire research and safety literature in the country. This collection is available to and used extensively by the entire fire safety community. The Information Service coordinates the Center's publication program and disseminates widely the Center's reports and publications.

- An Annual Conference on Fire Research brings together representatives of the principal research laboratories and others interested in fire safety, thus promoting personal interactions and exchanges of ideas and information.

Some specific recent accomplishments and projects now under way are described below:

Fire Safety Evaluation Systems

- Systems for estimating the relative level of fire safety of various types of facilities and the effectiveness of alternative fire protection strategies are being developed.

- The Fire Safety Evaluation System for Health Care Facilities is now included in Federal regulations and the National Fire Protection Association's Life Safety Code. A computerized cost optimization model for the application of this system for health care facilities has been completed. Application of the system to the retrofit of representative existing hospitals to meet new fire safety requirements has resulted in savings of millions of dollars. The potential savings run into the billions. This will help to hold down the rate of increase in the cost of medical care.

- A Fire Safety Evaluation System for Multi-family Housing has been developed for the Department of Housing and Urban Development to identify alternative combinations of widely accepted fire protection systems and building design features that provide a level of safety equivalent to that required by HUD Minimum Property Standards.
- The Fire Safety Evaluation System for Board and Care Facilities has been completed and accepted by the National Fire Protection Association's Subcommittee on Residential Occupancies for inclusion in the next edition of the Life Safety Code. Implementation of the system will provide increased fire safety for the elderly and the handicapped at affordable costs.
- The Fire Safety Evaluation System for Detention and Correctional Occupancies has been completed and accepted by the Subcommittee on Detention and Correctional Occupancies for inclusion in the next edition of the Life Safety Code.
- The Fire Safety Evaluation System for National Park Service Overnight Accommodations has been drafted and provided to the National Park Service for testing.
- A Fire Safety Evaluation System for Coal Mines is under development.

Toxicity of Combustion Products

- A test method for the evaluation of the acute inhalation toxicity of combustion products has been developed, published, and submitted to ASTM. The method is suitable for research and material development purposes but the results must be combined with additional factors to evaluate the toxic threat posed by a product in a specific application. The development of methods for carrying out such a toxic hazard analysis will be a major element of our program during the next three years.
- An interlaboratory evaluation of the test method, involving industrial, academic, and government laboratories, has been completed and a report is ready for publication.
- A Workshop was conducted to inform building code officials of the scope and application of the test method. A similar workshop will be held in California and perhaps in other locations. Members of the CFR staff participated in studies of the combustion product toxicity problem conducted by the National Fire Protection Association, the American Society for Testing and Materials, and the National Institute of Building Sciences.

- In cooperation with the National Fire Protection Association and the Federal Emergency Management Administration, we participated in studies of a number of major fires where smoke and gas produced numerous casualties. These included the MGM Grand Hotel fire, the Westchase Hilton fire, and the Biloxi Jail fire.

Smoke Control

- Work on a Building Smoke Control Systems Design Manual is nearing completion. This has been a joint project between the Center for Fire Research and the American Society for Heating, Refrigerating and Air Conditioning Engineers. The manual explains for the first time how to design and analyze pressurized stairwell systems and zone smoke control systems and includes a computer program for use with complex building designs. Publication is scheduled for 1983.
- Optical properties of smoke influence smoke detector performance. A laser has been used to make the first, direct measurement of the refractive index of individual smoke particles produced by smoldering α-cellulose. Further data will be taken to examine variation in refractive index among particles of different size produced by the same source and particles from different sources.
- The smoke leakage characteristics of fire doors affect the time available for safe refuge or egress from a burning building. A method for measuring the leakage of door assemblies during standard fire exposures has been developed and published.
- A series of full scale tests to evaluate smoke movement through a suspended ceiling into an interstitial space of a hospital type facility was conducted for the Veteran's Administration. It was concluded that the use of the interstitial space for exhaust can effectively prevent hazardous conditions due to smoke downflow through suspended ceilings.
- Smoke movement tests were performed on two merchant vessels and a report discussing the application of smoke control techniques to merchant ships has been published. Ventilation requirements for container ship holds were determined for the Coast Guard and the resulting recommendations have been adopted by the International Maritime Organization.
- In conjunction with a Guest Worker from Japan, a computer program was developed to predict the movement of smoke through a building. This will make possible the investigation of building design features and smoke control systems without the necessity for expensive full scale tests.
- A joint program to study smoke movement and control in stair towers was conducted with CSTB in France. These experiments made use of the French fire tower facility, thus avoiding the need to duplicate this costly facility in the United States.

Residential Sprinklers

- Demonstration tests of residential sprinklers were carried out in cooperation with FEMA. Changes were introduced into the NFPA sprinkler standard to make application of light duty sprinklers to residential occupancies economically feasible.

- Methods of estimating the response time of fast acting sprinkler heads necessary for residential life safety were developed. Such heads are now commercially available. The growth rate of most fires increases as the fire progresses, which makes the activation time of a sprinkler system critical to life safety. Full scale experiments were carried out on the effect of the location of pendent and sidewall sprinkler heads on their response characteristics in small enclosures. This information will be of use in efficient sprinkler system design. The use of scale modeling of buoyant flows to predict sprinkler activation in simple enclosures is underway.

- Risk assessment and engineering performance models for residential sprinklers are being developed. These studies will encourage the use of such systems in hotels and apartment buildings.

- The fundamentals of sprinkler performance are being studied to increase the effectiveness and reduce the cost of residential sprinkler systems.

Modeling of Fires

- Mathematical modeling of fire development promises to become a powerful tool for increasing the fire safety of all types of structures. It allows the examination of a wide range of fire environments and obviates much costly large scale testing. Rapid progress has been made in recent years and practical applications are now possible. The ultimate goal is to place Fire Protection Engineering on a sound technical base, comparable to other engineering disciplines.

- Detailed mathematical predictions have been made of large scale fluid motion and smoke transport generated by an enclosure fire. A two-dimensional model predicting fluid motion and smoke coagulation has been combined with a smoke detector model to simulate detector response. Preliminary results have been achieved with a three dimensional version of the particle tracking algorithm. This work will have application to the study of smoke detector siting and flame spread on walls and ceilings.

- A method has been developed for predicting the outflow of hot gases and the inflow of ventilation air through door and window openings of a room containing a burning object. These flow rates affect the growth rate of the fire and the supply of combustion products to the rest of a building. The technique has been validated by full scale experiments. The work is being extended to include wall fires.

- In the event of fire in a building compartment, the time available for the occupants to evacuate the compartment safely depends on the time of fire detection and on the time of the onset of hazardous conditions. To calculate this available safe egress time, a computer program and user's guide have been developed.

- A major project is underway to study the interaction of water droplet sprays with high momentum jet flames in order to elucidate the physico-chemical mechanisms responsible for flame suppression/extinguishment. The study will provide the basis for estimating the feasibility of using such sprays for offshore oil/gas well blowout fire protection. Due to the sheer scale of the problem manifested in the large quantities of gas involved in blowout fires it will be impossible to extrapolate or scale upward, with any degree of certainty, the results and conclusions of laboratory scale experiments without this fundamental understanding of the participating mechanisms.

Test Method Development

- A laboratory scale apparatus for the measurement of rate of heat release using the CFR developed oxygen consumption principle has been submitted to ASTM for adoption as a standard test method.

- The elegantly simple oxygen consumption principle is finding wide application in fire research. In CFR it has been scaled up to measure the rate of burning of full size furniture pieces and it has been incorporated in the full scale room fire test, developed jointly by CFR and a grantee at the University of California, which is now being considered by ASTM.

Combustion Research

- Fundamental studies of the mechanism of soot formation in fires are continuing. Soot is a major factor in creating hazardous fire conditions. It obscures vision, interfering with escape, rescue, and fire fighting; it provides a mechanism for transporting hazardous combustion products; the radiation properties of soot have a major influence in controlling the spread of fire; and smoke particles provide the most reliable mechanism for early detection of fires.

- The mechanism of smoldering combustion has been elucidated. This poorly understood process has been a major cause of deaths in residential fires. Better understanding of the mechanism will contribute to the development of smolder-resistant materials, the control of smoldering ignition, and better understanding of the toxicity properties of the products of smoldering combustion.

- Studies of the radiant ignition of a variety of fuels have led to a better understanding of the mechanism of ignition of fire fuels and contributed to improved test methods and ignition control.

Arson

- A decision analysis approach has been formulated and demonstrated to provide a planning tool for decision makers in a city or community concerned with selection and application of arson strategies. The Arson Information Management System (AIMS) provides information to describe the arson problem (classify causes/motivation, incidence and magnitude for each area in the city/community) and to establish which strategies are appropriate to address the causes. A method for using the outputs from the decision analysis to provide the most cost-effective use of an arson budget has been developed.

- Various commercial devices for the detection of accelerants (sniffers) were evaluated and a performance specification was developed to assist the authorities in procuring suitable equipment.

- An interlaboratory study of test methods used by various forensic laboratories to identify accelerants in fire debris was initiated. Early results indicated shortcomings in the methods. Efforts are under way to develop improved procedures which are expected to lead to the development of a standard test method.

Heating Appliance Fires

- An analysis was completed on over 1600 fire fatalities to identify the causes leading to demonstrated high fatality rates in rural areas. It was found that the most significant rural fire fatality cause was heating equipment with improper installation and misuse of solid fueled heating equipment predominating.

- The operation of solid fuel heating appliances was studied and improved methods for the safe design, installation, operation and maintenance of such devices were introduced into the fire safety standards.

DIRECT CONSEQUENCES OF PROPOSED CFR BUDGET CUT

1. The Center for Fire Research (CFR) would be abolished as an organizational entity at NBS.

   - The proposed cut represents all currently appropriated CFR funding.

   - Ability to attract other agency funding is dependent on sustaining basic capabilities.

   - Complete staff reduction of 50 professional and 50 support staff.

2. All university research grants--representing the only such source of proposed life-safety fire research in the U.S.--would be terminated.

   - Program consists of about 30 grants for $1.5-$2.0 million annually.

   - Recipients include leading universities, e.g., Harvard, Princeton, Cal Tech, University of California, Notre Dame, and industry research laboratories.

   - Termination would virtually stop the production of future fire science researchers and leading fire protection engineers.

3. Center for Fire Research test method development and fire test facilities would be shut down.

   - Facilities used to develop test methods for materials and fire prevention systems.

   - Facilities used to conduct fire tests for other agencies of government--an important and continuing NBS function for over 50 years.

4. The U.S. would be the only major civilized nation with no national fire research capability leading to potentially serious consequences to national and civil defense; to human loss and suffering; and to costs and reliability of buildings, plants, and transportation facilities from fire.

National Volunteer Fire Council

Chairman
E. James Monihan
45 Sussex Drive
Lewes, Delaware 19958
Home (302)-645-9064
Office (302)-645-3205

February 27, 1984

Congressman Douglas Walgren, Chairman
Subcommittee on Science Research
and Technology
2319 Rayburn House Office Building
Washington, D. C. 20515

Dear Congressman Walgren:

It is my understanding that the Center for Fire Research, located at the National Bureau of Standards, has been designated for elimination in documents before your committee.

This time last year the same action was taken and, at that time, the National Volunteer Fire Council went on record in opposition and, in fact, strongly supported and endorsed the functions of the Center. It has become, and certainly should continue to be, the center for all fire research by government agencies in the interest of economizing, centralizing and coordinating government effort in the study of fire and its behavior.

I am writing this letter to advise you, Congressman, that, as in the past, this Council stands firmly behind the Center for Fire Research and to solicit your continued support to assure that this fine facility will be permitted to carry on its most important mission. As you are well aware, we can make great efforts in extinguishing fires, however, it will only be through continued scientific research that these fires can be understood toward the end of protecting the people of the United States as well as the firefighters who must deal with them. It only stands to reason that if the scientific mechanism of fire can be better understood, the fire may be prevented from occurring and, inspite of all our well intended efforts, we cannot put back what the fire has destroyed prior to our successful extinguishment.

It seems, Congressman, that every time we communicate with you it is a plea for help and, while you have been most cooperative and supportive in our efforts, please be assured that we stand ready to assist you in anyway possible. We do appreciate your fine cooperation and insight in dealing with the fire problem and once again, must thank you for your efforts. Also to thank you in advance for your efforts on our behalf and that of the Center for Fire Research.

Yours truly,

E. James Monihan
Chairman

CC: Carryl Faye Brown
Research Assistant
Subcommittee on Science
Reasearch & Technology

NSB
National Small Business Association
"The Voice of Small Business"
Founded 1937

February 10, 1984

Ms Carry Brown
Research Assistant
Subcommittee on Science, Research & Technology
House Committee on Science & Technology
2326 Rayburn House Office Building
Washington, D.C. 20515

Dear Ms Brown:

As we discussed, enclosed are copies of testimony prepared by Carl Beck on our behalf. I should appreciate the statement being made part of the official record of the February 7th hearing.

Thank you again for your assistance earlier this week.

Sincerely,

Senga Howat

Senga Howat
Director of Research

NSB Building • 1604 K Street, N.W. • Washington, D.C. 20006 • Telephone (202) 293-8830

National Small Business Association
"The Voice of Small Business"
Founded 1937

STATEMENT OF

CARL A. BECK

ON BEHALF OF

THE NATIONAL SMALL BUSINESS ASSOCIATION

SUBMITTED TO THE

SUBCOMMITTEE ON SCIENCE, RESEARCH & TECHNOLOGY

HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

HOLDING HEARINGS ON THE

NATIONAL BUREAU OF STANDARDS AND RELATED AGENCIES

FEBRUARY 7, 1984

> "It is the declared policy of the Congress that the Government should aid, counsel, assist, and protect, insofar as is possible, the interests of small business concerns in order to preserve free competitive enterprise..."
>
> P.L. 85-536, as amended
> Section 2(a), Small Business Act.

NSB Building • 1604 K Street, N.W. • Washington, D.C. 20006 • Telephone [illegible] 8830

STATEMENT OF
CARL A. BECK
ON BEHALF OF
THE NATIONAL SMALL BUSINESS ASSOCIATION
SUBMITTED TO THE
SUBCOMMITTEE ON SCIENCE, RESEARCH & TECHNOLOGY
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
HOLDING HEARINGS ON THE
NATIONAL BUREAU OF STANDARDS AND RELATED AGENCIES
FEBRUARY 7, 1984

Mr. Chairman and Members of the Committee, my name is Carl A. Beck. I am Chairman of the Metrication Subcommittee of the Legislative Policy Committee of the National Small Business Association (NSB), and also serve as a member of the Executive Committee of the Board of Trustees of NSB which has represented small businesses located in every state of the Union since 1937. I am President of the Charles Beck Machine Corporation of King of Prussia, PA.

I offer this testimony on behalf of the small business community and in support of H.R.4490 entitled the "Metric Evaluation Act of 1984." May I offer the following as indicative of my continuing interest in the subject:

-- I have been active in the National Small Business Association for about 3 decades, and particularly regarding small business interests in Metric Transition for over a decade.

-- I participated in the drafting of the industry questionnaires for the NBS Study of Metrication in 1970, participated in the survey and the related NBS conferences, testified before both the House and Senate Committees regarding Metric Conversion, as well as on the Metric Conversion Act.

-- I was one of the U.S. participants in the Australian/North American Metric Conference, held in various cities in Australia.

-- Since its inception, I have been a member of the Board and Chairman of the Government Liaison Committee of the American National Metric Council.

-- When it was in existence, I was one of the two small business representatives on the U.S. Metric Board.

-- In connection with business trips, I have visited the South African Bureau of Standards to discuss metric transition, in 1980 and in 1983.

There are certain trends in metric transition in the U.S. which are, in reality, inescapable:

-- Whether it will require years or decades, the eventual change to predominately metric measurement in our country is inevitable.

-- Our multinational companies, as so many have done and are continuing to do, will change to hard metric conversion -- to facilitate interchange and minimize costs in international production and marketing.

-- Those small businesses who are suppliers to major corporations will, as they have to date, continue to supply them with metric parts and components, without significant difficulty or hardship.

-- General familiarity with the SI metric system in our lower schools and technical familiarity in colleges will increase with time, due to its inherent simplicity and coherence.

There are also global trends which, since they are mostly irreversible, must also be recognized:

-- Many countries, including the Common Market and all our major trading partners, have already or will shortly deny entry to products and materials which are not labeled or classified and delineated in SI Metric terms.

-- The new "Harmonized Commodity Description and Coding System", for which a draft is already completed (two years ahead of schedule) is completely metric only. (This is in agreement with GATT guidelines.) The target date for the new system to take effect is 1 January, 1987.

-- The U.S. Customs Regulations are due to be revised along with the Harmonized Commodity Descriptions, which will impact on the Tariff Schedule of the United States (TSUS).

-- In line with the above, preliminary discussions are being held with private sector interests and the Census Bureau, Office of Information and Regulatory Affairs of OMB and other agencies regarding possible actions to simplify and minimize reporting and record-keeping burdens under the Paperwork Reduction Act. In due time, similar attention will obviously be required for the many Custom reporting forms.

-- The Department of Defense has obligations to provide metric and metric-compatible weapons and equipment to facilitate maintenance and interoperability with our NATO partners.

Since the creation of the American National Metric Council, and the subsequent passage of the Metric Conversion Act, there has been considerable activity in metric transition in the private sector. In its limited existence, the U.S. Metric Board undertook considerable research. The current Administration has established the Office of Metric Programs in the Department of Commerce to continue certain aspects of the work of the Metric Board, and specifically to assist removing barriers to metric transition in the private sector.

Shortly before the first convening of the Metric Board, the General Accounting Office (GAO) undertook a study of metric conversion, which in the opinion of many was quite negative and in direct opposition to the NBS study. Several of the conclusions or inferences of the GAO report, such as the horrendous cost of conversion, have by now been thoroughly disproved. Not yet refuted, if ever, is the conclusion that the U.S. cannot live effectively under a dual measurement system, where both measurement languages have similar levels of use and credibility. Although the basis of the GAO report is now a decade old, it still retains many unanswered questions.

It behooves us now to look to the Legislative Branch of government to ascertain what its contribution has been to understanding and facilitation of voluntary private sector metric transition. In the decade since the passage of the (somewhat vague and confusing) Metric Act and concomitant aid to public school metric instruction methods, through the Department of Education grants, it has undertaken the following: NOTHING

And yet the country and the rest of the world still lives in confusion regarding the intent of the United States. To those who are in any way involved in metric transition, it appears that the private sector conversion is happening for good economic reasons, but in spite of rather than with the help of the Government.

Those of us who are in small business and are involved in exporting, like my company, are caught in the middle. Unlike the giant corporations who have gone to SI metrics, we are unable to do so unilaterally. General Motors metric automobiles have few "off-the-shelf" components, since their quantities are so huge. We in small business, on the other hand, buy one of these and two of those and make other parts and components which must be in customary configuration because they cannot otherwise be integrated with purchased items which are not metric. It does not mean we cannot sell overseas; it just makes selling overseas more difficult and expensive. Even though our own company's machines provide metric output, as demanded by our overseas customers, they contain no metric components, making maintenance and repair more difficult and costly for our customers. If it were not for the uniqueness of some of our machines capabilities, we would be completely unable to compete with foreign manufacturers of our type of equipment. Many small businesses don't care about whether their products are metric or not. But for those of us who send a portion of our production to overseas customers, however, metric products are fast becoming the sine qua non of foreign marketing.

As the Congress and the Administration attempt to encourage the small business community to increase or get into exporting, through the various legislative actions and incentives, they seem to lose sight of the fact that many of us will be jumping down a rat hole -- if we try to increase exports with customary units and non-metric products. Yet if we are to compete internationally, the United States must make a clear decision regarding metric transition. We in small business, as the GAO report says, cannot live with both -- the practical economics of a small business do not permit it.

I will agree that many people and groups are undecided on the metric issue, and this evidently includes the Congress. The question will not be adequately resolved until an understanding can be created of the benefits and costs, not only of going metric, but also of NOT going metric. It is my interpretation that this is the basic purpose behind House Bill 4490. It is therefore a very important step in the direction of finding a proper resolution of the metric question, and we of the small business community can only urge its passage as quickly as possible.

Thank you for the opportunity to submit our views.

American Iron and Steel Institute
1000 16th Street N.W., Washington, D.C. 20036

George T. Esherick
Vice President
Government Relations
(202) 452-7280

February 15, 1984

The Honorable Doug Walgren
Chairman
Subcommittee on Science,
   Research, and Technology
Committee on Science and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. ~~Chairman~~: Doug

The budget for the National Bureau of Standards submitted by the Administration calls for the elimination of the Center for Fire Research and the Center for Building Technology.

I am writing on behalf of the American Iron and Steel Institute to urge that you support the restoration of these funds to the NBS as you begin hearings on its FY 1985 budget.

The research resources required to effectively deal with the reported annual fire waste in the United States, which involves 8,000 deaths and $20 billion in direct and indirect property loss, is beyond the financial and technical resources of any one industry or industry group. The fire research effort requires the talent of many different scientific and engineering disciplines doing the pieces of research which are then fitted into the total fire safety puzzle. The Center for Fire Research has the staff and facilities to efficiently and effectively concentrate on the fire safety problem as it affects the public. No industry or existing private testing facilities can approach the research capabilities of the Center for Fire Research.

Currently industry is participating directly in research at CFR through the Research Associate Program. AISI is only one of many industry groups that have financially contributed to fire research studies at CFR. Several of these studies are explained in attachments to this letter.

The unique aspects of the fire problem necessitates the development of new test methods and time-consuming experimental evaluation required to test methods before recognition and acceptance by the technical community. These test methods are adopted by consensus action of the various voluntary code and standards writing organizations. In turn, the tests are adopted as part of the performance criteria in building regulations which are designed to protect the general public from injury and personal property loss resulting from fire. Because of the end use of fire test methods in building codes, the Center for Fire Research is especially suited to develop such tests and conduct the basic research. It is essential that the current broad base funding for this CFR activity be continued.

The Center for Building Technology has undertaken a wide range of activities which have resulted in improvements in construction technology and knowledge of structural and building performance resulting in design techniques to make buildings safer from the effects of natural hazards such as earthquake and wind storms. The CBT program has made major contributions in relieving the burden of unnecessary regulations on construction while maintaining essential levels of safety. Some of the significant studies and activities of the CBT are explained in attachments of this letter.

The Center for Building Technology and Center for Fire Research have proven records of accomplishments and offer unique facilities and perspectives that cannot be replicated by the private sector.

We, therefore, urge you and your colleagues to restore funds in the FY 1985 budget to enable them to continue their invaluable services to the Nation.

Sincerely

George

George T. Esherick
Vice President
Government Relations

Enclosure

A. ~~CFR~~ FIRE RESEARCH ON TOXICITY OF BURNING COMBUSTIBLES

Fire experience in the United States indicates that approximately 75 percent of fire deaths in building fires are caused by the toxic effects of the products of combustion from burning building materials and furnishings. In a recent report published by the National Fire Protection Association from a study by the Committee on the Toxicity of the Products of Combustion, seven primary areas were noted as requiring additional study. Three of these are related to research currently underway at the Center for Fire Research and are as follows:

(1) Standardized and improved methods of autopsy examinations and medical evaluations should be an integral of fire investigations; improved quality control of biochemical measurements made on fire casualities;

(2) Long term medical assessment of fire fighters and survivors of fires, especially for residual respiratory and cardiovascular changes; and

(3) Studies of the composition of combustion and pyrolysis products in the fire environment must be integrated with toxicological and medical evidence of the physiological effects in animals and fire casualties.

Recognition was given to the CFR biological toxicity test, but it was indicated that certain conditions should be studied to make the NBS test protocol more effective. The recommendations for further research are as follows:

(1) A uniform distribution of heat and smoke throughout the animal exposure chamber.

(2) Samples tested under conditions representative of their end use configuration.

(3) A method for determining a meaningful exposure time, especially for testing materials that decompose at different rates.

(4) Chemical measurements of the principle components of the combustion products.

(5) A method of monitoring and correcting for concentration changes due to absorption of combustion product mixture to which the animals are exposed.

(6) Sample weight loss versus time measurement (thermogravimetric monitoring).

(7) Measurement of toxicity in exposed animals short of death such as time to incapacitation and persistent effects in surviving animals.

The scope of any project involving toxicity of combustion products requires the interface of many different specialized disciplines and unique test facilities which can be productive in developing necessary test procedures. AISI has proposed a cooperative research program at the Center for Fire Research making use of the CFR laboratory fire research facilities and technical staff to study the following:

(1) Develop a toxic hazard assessment as part of any fire hazard assessment for life safety in fires.

(2) Combine the existing room fire growth models developed by AISI and CFR.

(3) Combine the research on standardizing a test method for determining the toxicity of combustion products with the AISI sponsored project for on the scene determination of death of fire victims which is to be studied in three cities in the United States with cooperation from the local fire department and the medical examiners office.

The proposed AISI budget for this work which is to compliment the work done at the Center for Fire Research is presently estimated at $185,000.

The proposed elimination of the CFR budget will virtually stop all work by industry on this subject.

B. CFR FIRE RESEARCH AND STRUCTURAL FIRE ENDURANCE PROGRAM

AISI has contributed significant research dollars at the Center for Fire Research in a joint research program developing reliable methods for evaluating fire endurance of structural building systems. The work done to date by AISI has been evaluated through the use of a complicated test program which can only be done at the Center for Fire Research.

Through the efforts and financial contributions by AISI, a large scale, two-story test building was erected and CFR instrumented the structure so as to measure the reaction of the test structure when exposed to fire. The research program completed at the Center for Fire Research was fundamental to the successful completion of a long term effort by AISI, the Institute for the Ironworking Industry and other related industries, aimed at improving life and property safety from fire. Eliminating the Center for Fire Research will effectively destroy the capability of the efforts of the private sector to find solutions to the building fire problem.

C. CFR FIRE RESEARCH ON HVAC SYSTEMS

AISI fire research conducted at CFR has provided important technical data for modifying building codes and fire safety standards on heating, ventilating and air conditioning systems including ductwork.

Following a serious fire in New York City, fire research sponsored by AISI was conducted at CFR to evaluate the influence of the HVAC system in that building fire in spreading fire to several additional floors. The NBS research found that specific conditions must be met when ductwork penetrates fire rated floors if fire spread is to be prevented. The results of this fire research were made an integral part of fire protection standards for the safe installation of air conditioning systems.

The spread of smoke in building fires was most obvious in the MGM Hotel fire in Las Vegas, Nevada. One of the factors in the spread of smoke and hot gases from the casino fire at ground level was the air handling system. Most of the fire deaths in the MGM Hotel fire were twenty floors or more above the uncontrolled fire in the casino. Studies in smoke control during building fires include the use of the existing HVAC system, because of the elevated temperature conditions, has been questioned by many authorities. Proposed research at CFR by AISI will study the performance of currently specified HVAC ductwork under fire conditions to determine the safety and effectiveness of duct system designs presently proposed by regulations for smoke control systems.

Test equipment, instrumentation, technicians and recording equipment available at the Center for Fire Research will be lost to industry seeking to study this problem if the CFR is eliminated from the Department of Commerce budget.

D. CBT INVESTIGATION OF MAJOR BUILDING AND CONSTRUCTION DISASTERS

The most dramatic success that CBT has had recently, is the definitive study on the collapse of two suspended walkways at the Hyatt Regency Hotel in Kansas City, Missouri. CBT had the technical staff to make such a study. They had the unquestioned support of the local community and they had access to the site that private organizations would not have had except with tight restrictions imposed by various financially interested parties. Never before had the construction industry learned the facts of a disaster so soon after the tragedy. There has been, for many years, routine thorough investigations of commercial airline accidents.

E. CBT EARTHQUAKE HAZARDS MITIGATION

One of the major hazards facing a great many Americans is an earthquake. Although there has been dramatic improvements (in some places) in building design and construction since the 1933 Long Beach, California, earthquake, which initiated real concern for seismic design, much is yet unknown. And what is known is not routinely applied in locations where seismic resistant construction will be seismicly tested one day. CBT is now involved in a project which they title "Technical Assessment of Earthquake-Resistant Design Provision." This effort has real value for the federal government which is the owner of a large number of buildings in active earthquake zones. It is also extremely practical for the whole construction industry. The latest improvements in seismic design provisions, drafted as a result of recent failures, have not yet been practically tested. The analytical research that is being done by CBT in conjunction with the Building Seismic Safety Council, a private organization with limited funds, will eventually save many lives.

INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS
1750 NEW YORK AVENUE, N.W., WASHINGTON, D.C. 20006
TELEPHONE NO. (202) 872-8484

John A. Gannon
President

Alfred K. Whitehead
Secretary-Treasurer

February 17, 1984

The Honorable Doug Walgren
Chairman
Subcommittee on Science Research & Technology
House Science & Technology Committee
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

Enclosed please find a statement expressing the views of the International Association of Fire Fighters (IAFF) on fiscal year 1985 funding for the Center for Fire Research.

I respectfully request that this statement be made part of the record for the hearings your Subcommittee held on this issue on February 7, 1984.

Thank you for your attention.

Respectfully,

Harold A. Schaitberger
Harold A. Schaitberger
Legislative Director

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Affiliated with:
AMERICAN FEDERATION OF LABOR AND CONGRESS OF INDUSTRIAL ORGANIZATIONS • CANADIAN LABOUR CONGRESS • NATIONAL FIRE PROTECTION ASSOCIATION

This is to submit the views of the International Association of Fire Fighters (IAFF), AFL-CIO-CLC, representing approximately 170,000 professional fire fighters throughout the country, to the House Science & Technology Committee on the issue of funding for the Center for Fire Research (CFR).

As you will recall during last year's budget deliberations the Administration recommended no funding for the CFR. However, the Center continued its existence after Congress authorized and appropriated funds for its continued operation. This year the Administration once again is seeking to eliminate the CFR and no monies have been included in the President's budget proposal for fiscal year 1985.

The IAFF is in strong support of the Center for Fire Research and respectfully requests that the Committee and Congress assure its continued existence by including adequate funding for the Center in fiscal year 1985 authorizations for the National Bureau of Standards.

The consequences of eliminating the CFR would be grim, since the Center carries out some of the most sophisticated research in fire prevention and control methods in the country. Advanced fire research is essential if our nation is to improve fire safety codes, standards and regulations; and the budget savings that the elimination of CFR provide would be offset many times over by the savings in lives and property that its work contributes to.

With the elimination of the CFR vital funds to leading universities and laboratories for research grants would be lost and basic knowledge of how flames spread, the role of soot formation in fire damage, and how to design safer materials would cease to grow.

This would come at a time when fire research is making dramatic improvements through the use of modern technology. Computer based fire simulators that can be used by building designers, code officials, fire service officers and fire fighters can be used to significantly decrease losses in life and property. Halting the CFR's work threatens this progress.

For these reasons the IAFF requests that adequate funding for the Center for Fire Research for fiscal year 1985 be authorized by the Committee during its current deliberations.

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